INNAMINCKA REGIONAL RESERVE

BIRDS, MAMMALS & VEGETATION SURVEY 2023

COONGIE ROAD

~ REPEAT OF 2014 SURVEY ~

A project undertaken by the Friends of the Innamincka Reserves

2014

2023

Dune near Coongie Road, Innamincka Regional Reserve

REPORT ON THE COONGIE ROAD BIRDS, MAMMALS & VEGETATION SURVEY 2023 – REPEAT OF 2014 SURVEY

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REPORT ON THE COONGIE ROAD BIRDS, MAMMALS & VEGETATION SURVEY 2023 – REPEAT OF 2014 SURVEY

INTRODUCTION

A. PROJECT FIELD TEAM AND COORDINATOR

This project was carried out as a volunteer activity by members of the Friends of the Innamincka Reserves (FOIR). There was no external funding for the project.

Field Team: Back L to R – Vern Treilibs, Euan Moore, Mark Anderson, Donna Moody, Mick Moody
Front L to R – Rose Treilibs, Jan Walker, Merilyn Browne, Jenny Rolland.
Project Coordinator: Kate Buckley

B. BACKGROUND

In 2014 FOIR volunteers established a survey method which could be used to monitor the impacts of both short- and long-term changes in environmental conditions on populations of bird, mammal and vegetation species in the Innamincka Regional Reserve. Using this methodology, the volunteers obtained baseline survey data for four 80-110 km spans along roads radiating out from Innamincka - the Bore Track North in 2013[1], the Coongie (Montepirie) Road in 2014[2], the Old Strzelecki & Loop Tracks in 2015[3] and the Cordillo Downs Road in 2017[4]. In 2016, high rainfall prevented access to the Reserve for a survey. These surveys were repeated along the Bore Track North in 2018[5], the Old Strzelecki & Loop Tracks in 2019[6], and the Cordillo Downs Road in 2022[7]. Surveys could not be conducted in 2020-2021 due to COVID restrictions. In this report, results are presented for the fourth repeat survey - the Coongie Road - conducted in 2023 using

[1] FOIR Bore Track North Survey Project Report 2013
[2] FOIR Coongie Road Survey Project Report 2014
[3] FOIR Old Strzelecki and Loop Tracks Survey Project Report 2015
[4] FOIR Cordillo Downs Road Survey Project Report 2017
[5] FOIR Bore Track North – Repeat of 2013 Survey Project Report 2018
[6] FOIR Old Strzelecki & Loop Tracks – Repeat of 2015 Survey Project Report 2019
[7] FOIR Cordillo Downs Road – Repeat of 2017 Survey Project Report 2022

the same methodology at the same sites as in the 2014 survey. This survey could not be repeated earlier (to maintain the order of roads surveyed) due to road closures following flooding.

The Coongie Road extends from Innamincka north-west to Malkumba-Coongie Lakes NP via Kudriemitchie. It passes through a range of habitat types from dry grasslands to wetlands.

While average rainfall is low (179 mm per annum), the Innamincka area is in a region of maximum rainfall variability for Australia. In 2010 the area experienced extreme rainfall in terms of scale and intensity, resulting in closure of several roads during 2010-2011. Since the 2014 baseline survey, there were good rains in 2016 with a total of 310 mm spread over several months, and above average rainfall in 2015 (185 mm), 2020 (254 mm) and 2022 (198 mm) with many years of low rainfall in between (Appendix V)[8].

The FOIR surveys provide data for monitoring changes in populations of terrestrial birds, mammals and vegetation as the weather conditions change between 'normal', dry and ecological boom. They also enable assessment of the impacts of other environmental changes such as mining, road-making and grazing.

C. APPROACH

Surveys were conducted along a ~110 km length of Coongie Road between Innamincka and Coongie Lake, following as closely as possible the transects and methodology of the baseline surveys conducted in 2014. There were 10 census stops, each 10 km apart. Surveys at each census stop comprised transects along two 500 m-sided quadrants, one on each side of the track. Landscape conditions did not require modification of census stop locations from those of the original 2014 survey although inaccuracies in the recorded location of corner points in the original survey resulted in some route differences for some of the transects in 2023.

D. OBJECTIVES

1. To collect data systematically for bird, mammal and plant species, at a series of survey transects spanning ~110 km in total along the Coongie Road within the Innamincka Regional Reserve and the Malkumba-Coongie Lakes National Park.
2. To relate species occurrence to short-term climatic and environmental variables.
3. To compare the survey data with that collected for the baseline Coongie Road survey conducted in 2014, assessing the impacts of longer-term changes in climate and environment on populations and species.
4. To use a bird survey technique equivalent to a 'fixed-route' survey as specified for the Birdlife Australia Atlas project.
5. To use these data to facilitate further monitoring of the change in flora and fauna population diversity and abundance as the conditions change to drier or wetter or due to other environmental impacts such as mining, road-making and grazing.

E. PROGRAMME OF RESEARCH

Surveys were conducted over 5 days between 27th July and 3rd August, 2023. The original survey was undertaken between 29th July and 4th August, 2014.

Coongie Lakes July 2023

[8] Bureau of Meteorology

METHODS

1. Survey overview and terminology

The tracks were surveyed using the method used for the baseline survey in 2014 and described below, travelling an average of 20-30 km per day along the track, with census stops at approximately every 10 km of track length. The survey method is adapted from methodology used by Rob Clemens and Richard Fuller (School of Biological Sciences, University of Queensland) for similar surveys in outback SA. The survey technique is equivalent to a 'fixed-route' survey as specified for the Birdlife Australia Atlas project.

Key terminology (see also diagram in Fig. 1 below):

A **census stop** is one of the points placed at intervals along the road. The census stop forms a central point for conducting surveys in the surrounding habitat. The locations of all census stops are provided as GPS waypoints. If the exact location of the waypoint proves to be inaccessible, then the point is established along the road closest to the waypoint location.

A **corner point** is one of the corner points of a survey square.

A **transect** is one of the sides of a survey square.

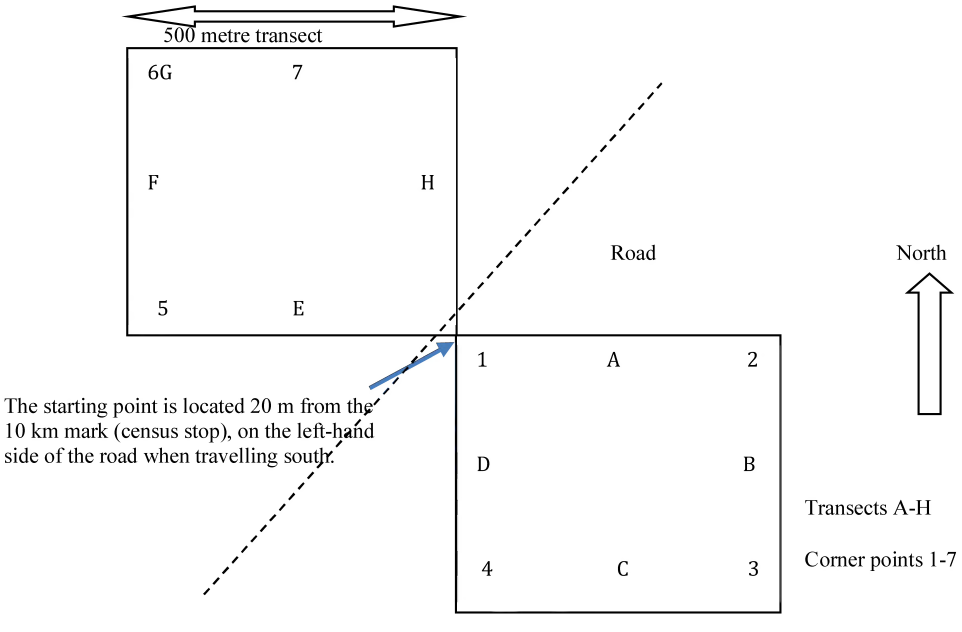


Fig. 1. Diagram of survey transect squares for each census stop

2. A typical day

A typical day commences at first light, travelling to the first census stop, surveying until around 11am-noon, when bird activity begins to decline noticeably. After a break during the heat of the day, surveys continue late in the afternoon when bird activity has increased again. Key equipment items for the surveys are listed in Appendix VIII.

3. Communication

The team maintains contact using vehicle and hand-held UHF radios.

4. Briefing session

Before commencing surveys, leaders brief the group on GPS technique for the survey and how to complete the survey sheets to ensure consistent data collection. The GPS co-ordinate system used is UTM and members must be familiar with how to select this on their GPS. A practice field session on using the GPS to complete a square is recommended. Two alternative methods for using the GPS to navigate a survey square are given in Appendix VI.

5. Survey work at each census stop

The following protocol was adopted for the baseline surveys and has been followed as closely as possible in all repeat surveys. When there are sufficient members in the group (as there was in 2023), half the group take the east survey and the other half the west survey at each census stop. Where possible, surveys should be conducted at the same time of day, i.e. morning or afternoon, as for the baseline survey.

(i) Upon arriving at a census stop, park the vehicle safely and place a hazard indicator (e.g. witch's hat) behind the cars if deemed necessary. Walk off the road 20 m from the census stop, left of the road when travelling south. Mark this starting location in the GPS (see diagram above, Fig. 1). Erect star dropper and attach metal tag with identifying detail e.g. 2014 FOIR 3. This is corner point 1 in Fig. 1. For repeat surveys, identify the star dropper that was put in place during the original survey. Attach an additional metal identifier tag for the current survey (see photos).

(ii) Write the co-ordinates onto the survey sheet to ensure they are not lost and note the weather details. Note down the dominant habitat type in the area surrounding the starting point (corner point 1). Choose from gibber, grassland, dunes, shrubland, lignum, woodland, wetland. Record dominant species in the vegetation if known. Take a photo of the survey sheet and then take representative photographs of the habitat at the starting point, one towards the centre of the eastern transect square and one towards the centre of the western transect square. When walking around each transect square in a clockwise direction (as was done for this survey), representative habitat photos are also taken at each corner, first towards the right (into the square) and then the left (outside the square).

(iii) Conduct line transect survey along each side of the two quadrats (see methods below under 6. Line Transect method and Appendix VI). As each transect line follows grid north/south or east/west, maintaining a constant grid northing or easting as appropriate allows the navigator to stay on the transect line. If your route must deviate around obstacles etc., return to the transect once the obstacle has been passed.

(iv) At 500 m from the starting point, i.e. at corner point 2, write the co-ordinates onto the survey sheet, note the time, and take a photo of the survey sheet and then of the habitat towards the centre and outside of the transect square as before. Continue in this fashion following the scheme in the diagram until 8 line transects have been completed. For repeat surveys, if copies of the original corner photos are available, use landmarks in these photos to help line up the repeat photos.

(v) Aim to complete all the survey work for each census stop within 1.5-2 hours if working as two teams.

6. Line Transect method

(i) Walk slowly along the transect line, looking and listening for birds. Pay careful attention for birds that are flushed from ground cover as you approach. For each individual or group of birds seen, note down (a) the species including age and sex if determined, (b) the number of birds in the group, (c) whether you heard and/or saw the birds, and (d) any evidence of breeding or feeding activity. Use a separate survey sheet for each 500 m transect. Avoid double counting on adjacent transects.

(ii) If you need to stop to check birds do so but try to keep a roughly even averaged slow walking pace throughout the transect.

(iii) There is no maximum distance for recording birds – every bird detected should be noted.

(iv) Note down any change in the dominant habitat type through which the transect passes (write across the line in the data collection columns). Record dominant species in the vegetation if known. Take representative photographs of the habitat. Ensure there is a photo of the survey sheet prior to the habitat photo so it is always clear which transect the photo belongs to.

(v) Note (write across the line in the data collection columns) and photograph any tracks or other traces and sightings of mammals/reptiles/birds. A photograph of tracks showing the gait of the animal/bird (i.e. set of prints) together with a ruler or measuring card (see photo) is useful for identification. A GPS reading for any significant sightings should be recorded.

Photograph of set of tracks with ruler

(vi) Record any threats or impacting factors noted e.g. soil erosion, weeds e.g. Buffel Grass (*Cenchrus ciliaris),* Mimosa Bush *(Vachellia farnesiana,* previously *Acacia farnesiana*), feral animals, mining, road-making, grazing, fire, water/drainage disturbance, strong wind.

7. Incidental surveys while driving between census stops

(i) When driving between census stops, sightings such as a particularly large group of birds, something very rare, or anything in the environment relevant to the aims of the study is recorded. These incidental survey records include a GPS reading followed by a 5 minute point count. The reason for the survey is noted e.g. “Cinnamon Quail-thrush crossed the road” and the surveys entered as an incidental survey in the Birdlife Australia Atlas database (Birdata).

(ii) Any wetlands that are visible from the road are surveyed with a count of any water-birds present (2 ha/20 min, 500 m radius or 5 min incidental survey as appropriate). The GPS location is recorded and the wetland photographed.

(iii) A count of all mammals (feral and domestic) is recorded.

(iv) Make a note of any items left on or near the road such as tyres, garbage or equipment and record any threats (as described above, 6(vi)).

RESULTS AND DISCUSSION

As for the baseline survey, 10 census stops were surveyed along the Coongie Road within the Innamincka Regional Reserve and Malkumba-Coongie National Park, following the transect routes for the 2014 survey. Except for Census Stops CL3 and CL6, time-of-day was closely matched with the original surveys. The exact location of the census stops and the co-ordinates for the survey points for the 2023 survey are given in Appendix I.

The rainfall at Innamincka is extremely variable as shown in Figs. 6 and 8 (Appendix V). Using data from Moomba station, 66 km south-west of Innamincka, where records are complete from 1996, an overall slight decrease in annual rainfall can be seen, although there was higher than average rainfall in the 3 years just preceding this survey (2020-2022). Considering rainfall close to the survey time, there was patchy rainfall in the previous 12 months recorded at Innamincka (Fig. 7). Of note, 18 mm was recorded in April, 21 mm in June and 11 mm earlier in July which could have resulted in the new plant growth noted for some of the transect surveys in this report. The survey team did have rain when they were based at Coongie Lakes between Census Stops 8 and 10 surveys (6.4 mm recorded at Innamincka Station on 29th July), but effects would not be expected during the timeframe of the surveys.

A. BIRD SURVEY DATA

2023 Report and Comparison with 2014 Survey

Bird surveys were conducted over five days between 27th July and 3rd August, 2023. In 2014 the surveys were carried out from 29 July to 4 August. Surveying was generally carried out in the mornings or later in the afternoon, where practical, when conditions were cooler and winds generally not so strong. Details of the 2023 bird survey data are given in Table 1 and Appendix II, and comparisons with the 2014 survey data are given in Tables 2 and 3 and Figs. 2-4.

In Table 1 and 2 unidentified corvids were not counted as an additional species as Little Crow and Australian Raven were also recorded at these census stops, however their numbers are included in the total number of birds. Similarly, unidentified martins were not counted as additional species as both Fairy and Tree Martins were present.

Across all surveys, 1907 individual birds were recorded from 62 species compared to 780 individual birds from 45 species in 2014. The average number of birds per census stop was 190.7 individuals, up from 78 in 2014, with an average of 19.5 species, up from 12.7 in 2014. This was a 38% increase in the number of species compared to 2014 and a 144% increase in the number of individual birds.

The overall density of individual birds more than doubled between the two surveys, increasing from 19.5 birds per kilometre of transect to 47.7 birds per kilometre.

Census Stop CL10 was the only location that showed a slight decline in the number of species from 31 to 30. Census Stop CL06 had the same number of species (13) as in 2014. All other census stops showed an increase in the number of species recorded. All census stops had an increase in the number of individual birds (Table 2).

Across the two surveys, a total of 72 species was recorded of which 10 species that were recorded in 2014 were not recorded in 2023. Conversely, 25 species were recorded in 2023 but not in 2014. Thirty-seven species were recorded on both surveys. At the census stop level, for 6 of the 10 census stops most of the species present in 2014 were again recorded in 2023. The exceptions were Census Stops CL01 and CL02 where only 25% of the species present in 2014 were recorded in 2023 and CL04 and CL06 where just under 50% of species from 2014 were recorded again in 2023.

The nine most common species recorded in 2023 had all been recorded in 2014 and were generally among the most common species recorded in 2014, although except for Tree Martins and Australian Ravens, the magnitude of their numbers had increased between the surveys. Fig 4 shows this comparison ordered by the

2023 survey results and includes three additional species from the top nine in 2014 that were not in the top nine for 2023 although all were still present in good numbers.

The observed changes in bird numbers can most likely be attributed to the above average rainfall for the previous three years. Across all census stops the amount of vegetation and the availability of flowers, seeds and insects would have been greater than during the 2014 survey. This likely resulted in the large flocks of Little Corellas seen on some transects in 2023.

Across the 2023 survey nearly every woodland or grassland bird species showed an increase in numbers. Apart from Diamond Dove (10 recorded in 2014, 1 in 2023) and Purple-backed Fairy-wren (11 in 2014, 3 in 2023), it was only those species that were present in low numbers (< 5) across both surveys that did not show a clear increase in numbers.

Some of the census stops, particularly in the north came close to Cooper Creek or included flood channels and overflow areas. This clearly contributed to the increased number of water birds recorded. Eight of the 25 additional species in 2023 were strongly associated with water or wetlands. These included cormorants and darter, ducks, herons, Ibis and Brolga. Australian Pelican was recorded on both surveys but in 2023 was the second most frequent bird recorded when they were disturbed from the river or recorded in flocks flying low overhead. Cormorants were found along the river but other water birds were also recorded on or near surface water within the lignum wetlands.

Table 1: Summary of counts by census stop for each bird species along the Coongie Road – 2023 survey

Species	No. of census stops where present	Total count	Min. count/ stop when present	Max. count/ stop when present	Ave. /stop when present	Ave. for all 10 stops	Birds/ km of tran-sect
Australasian Darter	1	5	5	5	5.0	0.5	0.1
Australian Bustard	1	1	1	1	1.0	0.1	0.0
Australian Magpie	1	2	2	2	2.0	0.2	0.1
Australian Pelican	6	257	4	94	42.8	25.7	6.4
Australian Pied Cormorant	1	4	4	4	4.0	0.4	0.1
Australian Raven	7	29	2	11	4.1	2.9	0.7
Black-eared Cuckoo	1	1	1	1	1.0	0.1	0.0
Black Honeyeater	1	1	1	1	1.0	0.1	0.0
Black Kite	4	15	1	10	3.8	1.5	0.4
Black-faced Cuckooshrike	1	1	1	1	1.0	0.1	0.0
Black-faced Woodswallow	9	109	6	19	12.1	10.9	2.7
Black-fronted Dotterel	1	4	4	4	4.0	0.4	0.1
Bourke’s Parrot	2	3	1	2	1.5	0.3	0.1
Brolga	1	1	1	1	1.0	0.1	0.0
Brown Falcon	3	8	1	5	2.7	0.8	0.2
Brown Treecreeper	4	6	1	2	1.5	0.6	0.2
Chestnut Teal	1	1	1	1	1.0	0.1	0.0
Chestnut-crowned Babbler	1	3	3	3	3.0	0.3	0.1
Chestnut-rumped Thornbill	1	2	2	2	2.0	0.2	0.1
Chirruping Wedgebill	7	22	1	5	3.1	2.2	0.6
Cinnamon Quail-thrush	2	2	1	1	1.0	0.2	0.1
Crested Pigeon	8	38	1	10	4.8	3.8	1.0
Crimson Chat	5	10	1	3	2.0	1.0	0.3
Crow/Raven sp.	3	19	2	12	6.3	1.9	0.5
Diamond Dove	1	1	1	1	1.0	0.1	0.0
Eastern Bluebonnet	3	9	3	3	3.0	0.9	0.2
Galah	7	132	4	54	18.9	13.2	3.3
Great Cormorant	1	1	1	1	1.0	0.1	0.0
Grey Shrike-thrush	3	7	1	5	2.3	0.7	0.2
Horsfield's Bronze Cuckoo	3	3	1	1	1.0	0.3	0.1
Inland Dotterel	1	2	2	2	2.0	0.2	0.1
Jacky Winter	3	8	1	5	2.7	0.8	0.2
Little Corella	5	405	2	250	81.0	40.5	10.1
Little Crow	9	107	2	37	11.9	10.7	2.7
Little Eagle	2	2	1	1	1.0	0.2	0.1
Magpie-Lark	6	20	1	7	3.3	2.0	0.5
Maned Duck	1	2	2	2	2.0	0.2	0.1
Mistletoebird	2	2	1	1	1.0	0.2	0.1

Table 1: Summary of counts by census stop for each bird species along the Coongie Road – 2023 survey. Continued.

Species	No. of census stops where present	Total count	Min. count/ stop when present	Max. count/ stop when present	Ave. /stop when present	Ave. for all 10 stops	Birds/ km of tran-sect
Nankeen Kestrel	1	2	2	2	2.0	0.2	0.1
Peaceful Dove	2	3	1	2	1.5	0.3	0.1
Pied Honeyeater	1	1	1	1	1.0	0.1	0.0
Purple-backed Fairy-wren	1	3	3	3	3.0	0.3	0.1
Red-backed Kingfisher	1	1	1	1	1.0	0.1	0.0
Red-browed Pardalote	5	14	1	6	2.8	1.4	0.4
Red-capped Robin	4	14	1	6	3.5	1.4	0.4
Red-rumped Parrot	4	14	1	6	3.5	1.4	0.4
Rufous Songlark	1	1	1	1	1.0	0.1	0.0
Singing Honeyeater	1	1	1	1	1.0	0.1	0.0
Southern Whiteface	3	6	1	3	2.0	0.6	0.2
Spiny-cheeked Honeyeater	4	12	1	8	3.0	1.2	0.3
Straw-necked Ibis	1	15	15	15	15.0	1.5	0.4
Tree Martin	5	72	1	56	14.4	7.2	1.8
Wedge-tailed Eagle	1	4	4	4	4.0	0.4	0.1
Whistling Kite	5	19	1	8	3.8	1.9	0.5
White-backed Swallow	2	3	1	2	1.5	0.3	0.1
White-browed Woodswallow	1	2	2	2	2.0	0.2	0.1
White-necked Heron	1	2	2	2	2.0	0.2	0.1
White-plumed Honeyeater	4	99	13	46	24.8	9.9	2.5
White-winged Fairy-wren	10	93	3	13	9.3	9.3	2.3
Willie Wagtail	5	15	1	6	3.0	1.5	0.4
Yellow-throated Miner	8	117	1	30	14.6	11.7	2.9
Zebra Finch	8	149	1	49	18.6	14.9	3.7
Total species	**62**						
Total individuals	**1907**						**47.7**

Table 2: Comparison of numbers of species and birds observed for each census stop for baseline (2014) and repeat (2023) surveys						
Census Stop	2014		2023		%Change from baseline	
	No. of species**	No. of individuals	No. of species**	No. of individuals	No. of species**	No. of individuals
CL01	8	23	10	24	11%	4%
CL02	8	27	11	110	38%	307%
CL03	2	4	11	46	450%	1050%
CL04	9	52	25	413	178%	694%
CL05	13	109	27	164	108%	50%
CL06	13	104	13	142	0%	37%
CL07	24	102	30	218	25%	114%
CL08	9	52	13	195	44%	275%
CL09	10	122	25	300	150%	146%
CL10	31	185	30	295	-6%	59%
Total	**45**	**780**	**62**	**1907**	**38%**	**144%**
Average	**12.7**	**78.0**	**19.5**	**190.7**	**101%**	**274%**

**Excludes unidentified corvids and martins.

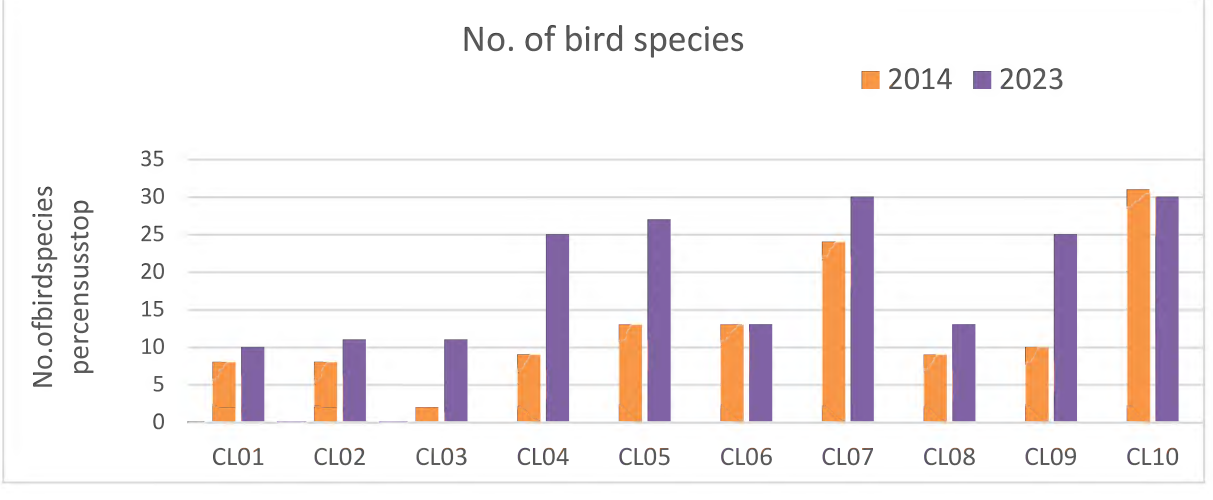


Fig. 2 Comparison of number of bird species at each census stop

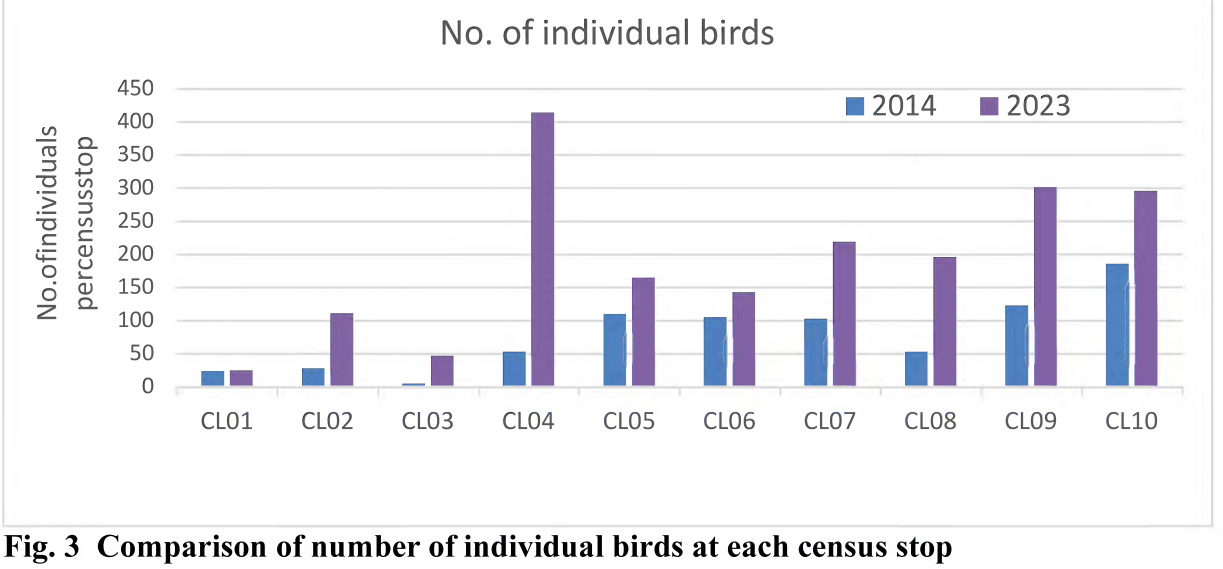


Fig. 3 Comparison of number of individual birds at each census stop

Table 3: Comparison of counts for each bird species for baseline (2014) and repeat (2023) surveys

	2014			2023			
Species	No. of census stops where present	Total count	Birds per km of transect	No. of census stops where present	Total count	Birds per km of transect	Change between surveys (Birds/km)
Australasian Darter	1	1	0.03	1	5	0.13	0.10
Australian Bustard				1	1	0.03	0.03
Australian Magpie				1	2	0.05	0.05
Australian Pelican	2	17	0.43	6	257	6.43	6.00
Australian Pied Cormorant				1	4	0.10	0.10
Australian Raven	9	51	1.28	7	29	0.73	-0.55
Australian Ringneck	1	2	0.05				-0.05
Australian Shelduck	1	2	0.05				-0.05
Black-eared Cuckoo				1	1	0.03	0.03
Black Honeyeater				1	1	0.03	0.03
Black Kite	2	3	0.08	4	15	0.38	0.30
Black-chinned Honeyeater	1	1	0.03				-0.03
Black-faced Cuckooshrike	1	1	0.03	1	1	0.03	0.00
Black-faced Woodswallow	9	41	1.03	9	109	2.73	1.70
Black-fronted Dotterel				1	4	0.10	0.10
Bourke's Parrot				2	3	0.08	0.08
Brolga				1	1	0.03	0.03
Brown Falcon	1	1	0.03	3	8	0.20	0.18
Brown Treecreeper				4	6	0.15	0.15
Caspian Tern	1	1	0.03				-0.03
Chestnut Teal				1	1	0.03	0.03
Chestnut-crowned Babbler				1	3	0.08	0.08
Chestnut-rumped Thornbill	1	2	0.05	1	2	0.05	0.00
Chirruping Wedgebill				7	22	0.55	0.55
Cinnamon Quail-thrush				2	2	0.05	0.05
Crested Pigeon	5	16	0.40	8	38	0.95	0.55
Crimson Chat	2	9	0.23	5	10	0.25	0.03
Crow/Raven sp.	7	57	1.43	3	19	0.48	-0.95
Diamond Dove	1	10	0.25	1	1	0.03	-0.23
Eastern Bluebonnet				3	9	0.23	0.23
Emu	1	4	0.10				-0.10
Fairy Martin	2	3	0.08				-0.08
Galah	4	114	2.85	7	132	3.30	0.45
Great Cormorant				1	1	0.03	0.03
Grey Shrike-thrush	3	6	0.15	3	7	0.18	0.03
Horsfield's Bronze Cuckoo				3	3	0.08	0.08
Inland Dotterel				1	2	0.05	0.05
Jacky Winter	3	7	0.18	3	8	0.20	0.03

Table 3: Comparison of counts for each bird species for baseline (2014) and repeat (2023) surveys. Continued

	2014			2023			
Species	No. of census stops where present	Total count	Birds per km of transect	No. of census stops where present	Total count	Birds per km of transect	Change between surveys (Birds/km)
Little Corella	2	6	0.15	5	405	10.13	9.98
Little Crow	3	4	0.10	9	107	2.68	2.58
Little Eagle				2	2	0.05	0.05
Magpie-Lark	2	4	0.10	6	20	0.50	0.40
Maned Duck				1	2	0.05	0.05
Martin sp.	2	4	0.10				-0.10
Mistletoebird	2	4	0.10	2	2	0.05	-0.05
Nankeen Kestrel	2	3	0.08	1	2	0.05	-0.03
Pacific Black Duck	1	1	0.03				-0.03
Peaceful Dove	1	6	0.15	2	3	0.08	-0.08
Pied Honeyeater				1	1	0.03	0.03
Purple-backed Fairy-wren	3	11	0.28	1	3	0.08	-0.20
Red-backed Kingfisher	2	2	0.05	1	1	0.03	-0.03
Red-browed Pardalote	2	4	0.10	5	14	0.35	0.25
Red-capped Robin				4	14	0.35	0.35
Red-rumped Parrot	1	6	0.15	4	14	0.35	0.20
Rufous Songlark	1	1	0.03	1	1	0.03	0.00
Singing Honeyeater				1	1	0.03	0.03
Southern Whiteface				3	6	0.15	0.15
Spiny-cheeked Honeyeater	2	3	0.08	4	12	0.30	0.23
Straw-necked Ibis				1	15	0.38	0.38
Tree Martin	4	104	2.60	5	72	1.80	-0.80
Wedge-tailed Eagle	4	5	0.13	1	4	0.10	-0.03
Whistling Kite	7	19	0.48	5	19	0.48	0.00
White-backed Swallow	1	2	0.05	2	3	0.08	0.03
White-breasted Woodswallow	1	2	0.05				-0.05
White-browed Woodswallow	1	2	0.05	1	2	0.05	0.00
White-necked Heron				1	2	0.05	0.05
White-plumed Honeyeater	8	68	1.70	4	99	2.48	0.78
White-winged Fairy-wren	8	42	1.05	10	93	2.33	1.28
White-winged Triller	1	1	0.03				-0.03
Willie Wagtail	7	17	0.43	5	15	0.38	-0.05
Yellow-throated Miner	4	17	0.43	8	117	2.93	2.50
Zebra Finch	7	93	2.33	8	149	3.73	1.40
Total no. of individuals		**780**	**19.50**		**1907**	**47.68**	**28.18**

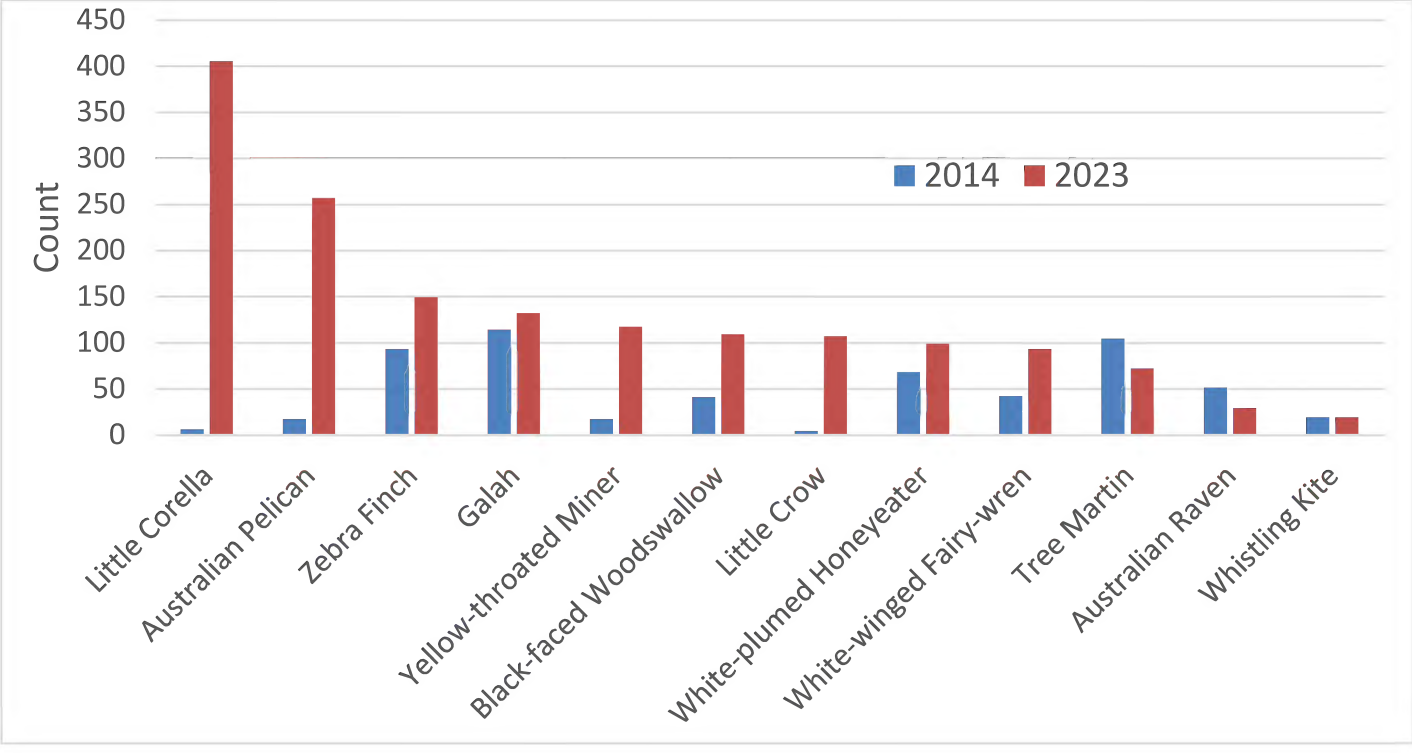


Fig. 4 Comparison of counts for the 9 top-listed birds for the 2014 survey and the top 9 for the 2023 survey.

B. HABITATS

The north-west Branch of the Cooper Creek and its associated channels, some of which contain permanent water, have created a unique environment in an arid landscape. After sufficient rain in the Cooper catchment in north-east Queensland, water will flow north from the main Cooper Creek via the channels into the Coongie Lake system. However it is the local rainfall, timing and magnitude, which determines the greatest biological and vegetative response in the terrestrial environment.

Rainfall in the second half of 2022 had provided a boost to the vegetation and more recent smaller rainfall events had helped maintain plant growth, At the time of the survey there were still ephemeral plants flowering. Other plants, such as grasses had had sufficient time to produce seeds.

Statistically, a great flood which inundates the region except for the very top of the dunes, occurs about once every thirty years. However the most recent of these occurred in 2011-12 creating a 'boom' period. Since then the landscape went through a drying phase until 2015 and 2016 when there was above average rainfall. Rainfall was again above or near average from 2020 – 2022 with significant falls towards the end of 2022. In 2023 there were intermittent falls in the months leading up to and during the survey.

Overall the landform in this area of the reserve has gentle gradients and low relief. It is dissected by water courses, associated with Cooper Creek, as well as dunes of varying heights up to 5 m. These run in a roughly north-south direction. Much higher dunes are found in the reserve but outside the survey area. The landforms can be divided up into 4 or 5 types, riverine, dunal, dune fields or interdunal complex and flood plain – sand flat or clay pan. Although there is much intergrading, each of these landforms carry their particular vegetation complexes and associated habitat. This was reflected in the number and types of birds observed in each habitat (see Table 4).

The Coongie Road crosses a variety of these arid zone habitats.

The transects closer to Innamincka tended to include interdunal complexes and flood plains. The interdunal complexes were generally of low relief and sparsely vegetated, generally dominated by Coolibah (*Eucalyptus coolabah)* with occasional large trees/shrubs such as Whitewood (*Atalaya hemiglauca*) and Queensland Bean (*Lysiphyllum gilvum*). Rainfall in the previous year had resulted in some germination of grasses and ephemeral herbs however this area tended to be more heavily grazed by cattle. Ground cover by vegetation was generally less than 30%.

The flood plains are of variable soil composition and may be clay, sand, or clay with a sand veneer. They contain a sparse low vegetation of variable composition, dominated by ephemeral or short-lived perennial species. Typical of these are forbs such as *Sclerolaena sp.* and Native Tobacco (*Nicotiana velutina*). On the sandy flats Lignum (*Duma florulenta*) and Golden Goosefoot (*Chenopodium auricomum*) were seen often in patches separated by small overflow channels. The clay pans were bare, with some in the north showing signs of increasing salinity. The lower diversity of vegetation on the dune fields and more heavily grazed sand and clay plains correlated with lower numbers of birds and bird species in both surveys.

Dunes were encountered in the central and northern census stops. These were also thinly vegetated. In 2014 the dunes contained many dying plants which by 2023 were less obvious although vegetation was sparser in 2023 (see corner point photos, Appendix III). Dune crests tended to be dominated by Cane-grass (*Zygochloa paradoxa*), with some *Crotalaria sp*. Although this habitat is reputedly critical habitat for the Eyrean Grass Wren, none were seen. The lower dune slopes sometimes had patches of spinifex (*Triodia sp.*) with some isolated sandhill *Acacia sp*. Many of these dune systems had been heavily impacted by rabbits.

The riparian or woodland complexes were encountered alongside the Kudriemitchie Channel inside the park closer to the lake, although some woodland complexes occurred at the boundaries of dune fields and flood plain. These are the most floristically complex and contain vegetation at several stratified levels, generating a lot of leaf litter. The channel is fringed with River Red Gums (*E. camaldulensis*) and other large trees and shrubs including Coolibah (*E. coolabah)*, and River Cooba (*Acacia stenophylla*). The rainfall and minor flooding over the previous year had resulted in extensive plant growth around the overflow channels.

Ground cover in these areas ranged from 60% - 100%. Here the greatest number and variety of woodland birds was also seen.

Coongie Lake is surrounded by dunes lined with Coolibah and River Red Gum while the freshwater lake edge is lined with grasses, sedges and ephemerals such as *Stemodia florulenta.* At the time of the survey the lake was close to capacity with water extending onto clay pans to the south which held large numbers of waterbirds. The surrounding sand dunes however were in poor condition with little vegetation and showing signs of wind erosion.

Surface water was available across much of the survey area. Transects at the northern census stops were close to the creek which still had a small flow. Overflow channels and flood plains were still damp and sometimes contained isolated pools of water. Rainfall during the survey resulted in small areas of surface water in many of the more low-lying areas.

Photographs taken from the corner points and along the transects showing the habitats and flora are given in Appendix III.

Comparison with 2014 survey

Appendix III shows the seven pairs of corner point photos that were taken at each census stop during the 2014 and 2023 surveys. During the 2023 survey, copies of the photos from the original survey were used in an effort to match photos to the earlier survey. In a few cases corner point photos were not available from the original survey or the original photo point had not been recorded accurately. In many cases there is a difference in perspective due to different cameras/lenses being used on the two surveys however in these instances there are identifiable trees or other features that enable the photos to be matched.

Census Stops CL01 – CL04 generally had more extensive areas of bare ground and mobile soils in 2023 than in 2014. There was less vegetation cover at most of these corner points than in the original survey. Many of the Coolibah trees were in poorer health with more dead branches e.g. CL02 corner point 2. There were relatively few woody shrubs present. There were also more indications of active wind erosion. These census stops are on sand plains with generally flat topography. They are also closer to Innamincka. They probably have higher grazing intensity than Census Stops CL05 – CL08 which are further from Innamincka but still outside the Malkumba-Coongie National Park.

The central section of the survey which included Census Stops CL05 – CL08 generally had greater vegetation cover in 2023 than in 2014. Part of this would be due to the presence of overflow channels along some transects. These have created a wetter environment. The channels themselves often had almost 100% vegetation cover consisting of Nardoo and other wetland plants. Coolibah trees in this area generally had a similar amount of leaf cover across the two surveys. Where transects at these census stops crossed low dunes or sand plains, the vegetation cover was similar across the two surveys. While there was still evidence of cattle grazing at these census stops, the impact was not as great.

Census Stops CL09 and CL10 are both within the Malkumba-Coongie National Park. This area includes larger dunes than were encountered at other census stops as well as clay pans that are subject to flooding. Where these transects crossed dunes, the vegetation cover was less in 2023 than in 2014 (CL10 corner point 3). The clay pans also held less vegetation in the later survey. The presence of dead trees and trees with reduced leaf cover along with more extensive areas of bare clay may be an indication of increasing salinity. In contrast to this, the areas of Lignum wetland had similar amounts of vegetation across the two surveys.

Table 4: Number of bird species by vegetation type at census stops

Census Stop	Topography	Vegetation types		No. of bird species	
				2014	2023
CL01	Flood plain / sand plain	Tussock grassland	Open woodland	8	10
CL02	Flood plain / sand plain	Open tussock grassland	Open woodland	8	11
CL03	Sand plain, low dune	Sparse tussock grassland		2	11
CL04	Flood plain / low dunes	Open woodland / grassland	Hakea shrublands	9	25
CL05	Dunes / flood plain, creek line	Open shrubs and grassland, some shrubs	Open Coolibah woodland, Acacia. Lignum	13	27
CL06	Flood plain / low dunes	Sparse Coolibah woodland	Open grassland and arid woodland	13	13
CL07	Low dunes / creek line	Open tussock and Cane-grass. Sparse Hakea	Coolibah woodland with Lignum	24	30
CL08	North-south sand dunes	Grassland (tussock, Cane-grass and Triodia sp.) with scattered shrubs		9	13
CL09	Flood plain	Lignum with sparse Coolibah trees		10	25
CL10	Sand dunes and creek	Tussock and shrubs on dunes	Glasswort, Coolibah woodland and Lignum along creek	31	30

C. FLORA

In the years leading up to this survey there had been minor flooding of Cooper Creek and some local rain with significant rainfall events between August and December 2022, approximately 8-12 months prior to the survey. This had resulted in fresh plant growth in all habitats although it was most noticeable in those areas that had most recently flooded. The riverine vegetation communities bordering the channels are by far the most diverse and complex, exhibiting several floral layers.

The Riverine/Woodland Complex

Along the Kudriemitchie Channel, a permanent water source, the dominant tree was the River Red Gum (*E. camaldulensis)*, also with some Coolibah (*E. coolabah)* and River Cooba (*Acacia stenophylla)*. Below this was an understorey of Broughton willow (*Acacia salicina)*, Queensland Bean-tree (*Lysiphyllum gilvum)* and an occasional Plum Bush (*Santalum lanceolatum)*, Wild Orange (*Capparis mitchellii)*, or Sour Plum (*Owenia acidula)*. Scattered below this were *Eremophila sp*. *E. bignoniiflora*, and *E. longifolia*. Still shorter understorey species included *Duma florulenta*, *Chenopodium auricomum, Atriplex nummularia* and *Enchylaena tomentosa.* The remains of a range of forbs such as *Sclerolaena sp.* (*S. intricarta, S. bicornis*), *Teucrium racemosum, Pterocaulon sphacelatum* and *Nicotiana velutina* and grasses such as *Eragrostis sp.* and *Sporobolus sp.* were also observed. The damp bank adjacent to the waterline was covered in couch (*Cynodon dactylon).*

Along damp water channels there was a dense cover of Nardoo, *Marsilea sp.*, along with associated wetland plants. The edges of these water channels were lined with large bushes of Lignum, *Duma florulenta,* and Coolibah

Dunes

The dune crests were thinly vegetated with Cane-grass (*Zygochloa paradoxa*) and some drying *Crotalaria sp*., typically *C. eremaea and C. cunninghamii*. Scattered lower down the slopes were spinifex hummocks *Triodia basedowii*, *Acacia ligulata, Acacia oswaldii, Atriplex velutinella, Trichodesma zeylanicum, Enchylaena tomentosa* with the very occasional remnant grass tussock (*Aristida sp*.). These areas showed the greatest impact from rabbits and appeared to be entering an unstable state.

A well-vegetated sand plain with *Acacia spp*. and a ground cover of ephemeral herbs. It shows some evidence of cattle grazing.

Interdune Complex/Dune field

This landform was by far the most common and unlike in the original survey, showed good amounts of vegetation in some areas. Although the dominant tree along the track was often stunted *E. coolabah*, other species such as *Hakea leucoptera* and *Atalaya hemiglauca* were quite prevalent around the mid-section of track. Isolated trees such as *Bauhinia gilva, Grevillea striata*, *Owenia acidula, Santalum lanceolatum* occurred rarely in this landform. Stands of *Acacia sp*. (*A. victoriae* and *A. tetragonophylla)* are sometimes scattered amongst stands of *Eremophila sp*. (*E. duttonii*, *E. glabra*) and *Senna artemisioides*. In some instances *Acacia tetragonofolia* was forming small trees up to 5m high. Smaller bushes such as *Dodonaea viscosa*, *Enchylaena tomentosa, Atriplex nummularia, Lechenaultia divaricata* tended to be scattered along old drainage lines. Forbs such as *Teucrium racemosum, Euphorbia tannensis* and *Sclerolaena sp.* including *S. bicornis* and *S. intricarta* were sparsely distributed. In the National Park where the cattle had not been, patches of remnant summer grasses such as *Enneapogon avanaceus* and *Eragrostis sp.* could still be observed.

The drier dunes and sand plains showed greater variation in plant cover. In some areas the fresh growth of herbs had been reduced by browsing animals while in other areas there was a good cover of ephemeral herbs such as *Senecio gregorii*, *Nicotiana velutina,* and saltbushes.

Flood plains – Sand flats, clay pans

Clay pans were generally bare - devoid of vegetation.

Sand flats were covered in varying densities of Lignum (*Duma florulenta*) often associated with Queensland Blue Bush (*Chenopodium auricomum)* and possibly Cane-grass *Eragrostis autralasica.* A variety of forbs were found on the fringes such as *Sclerolaena sp*., *Crinum flaccidum*, *Teucrium racemosum, Enchylaena tomentosa* and *Pterocaulon sphacelatum.*

Clay pans and other areas that are more frequently flooded had a good cover of Lignum, *Duma florulenta* separated by open areas that often held water.

At the northern Census Stops (CL09 and CL10) there was cattle damage to some of these wetlands within the National Park.

On the sand flats immediately adjacent to the dunes which surround Coongie Lake itself, there is a dense covering of *Tecticornia indica* interspersed with *Sclerolaena bicornis.*

It was also concerning to see clay pans at Census Stops CL09 and CL10 where woody vegetation appears to have been killed by increasing amounts of salt in the soil. At these locations there was some saltbush however even these appeared unhealthy.

The photos in Appendices III and IV show examples of the flora and its habitat as encountered along the transects.

A healthy flood plain community dominated by Lignum, *Duma florulenta.*

Clay pan showing dead Coolibah, top right, and recent trampling by cattle.

D. MAMMALS

1. Cattle

Census Stops CL01 – CL08 are all within the Innamincka Regional Reserve where grazing is permitted. All of these census stops showed some evidence of cattle grazing or their movements. The intensity of activity was similar to that seen in previous years with well-defined tracks, dispersed tracks and signs of browsing. Census Stops CL9 and CL10 are within the Malkumba-Coongie National Park. A mob of cattle as well as several individuals were seen between these census stops (photo) within the National Park. Heavy cattle tracking and damage was recorded at both CL09 and CL10, particularly in wet areas.

A small mob of cattle in Malkumba-Coongie National Park

2. Feral horses/donkeys

Old horse/donkey scats were recorded at one location at Census Stop CL07. No tracks were recorded.

3. Rabbits

Rabbits were seen near Census Stops 9 and 10 where there were large warrens in the sand dunes. At these stops there were frequent rabbit scats. Rabbits were less prominent with fewer warrens, scrapes or latrines, at the more southerly census stops where the dunes are smaller and there are larger areas of sand and clay plains.

4. Dingo

Dingo tracks and scats were recorded at Census Stops CL01, CL03, CL05 and CL10. On CL03 the skull of a small dingo was found (photo page 85)

5. Cat

Feral cat scats were recorded at CL01.

6. Fox

No evidence of foxes was recorded during the survey.

7. Camel

Camel tracks were recorded at CL01 and CL07 (photo page 101). No camels were seen during the survey or on the days either side of the survey.

8. Kangaroos

Kangaroo scats and occasional tracks were recorded at Census Stops CL01, CL02, CL03 and CL08. Kangaroos are present in low numbers across the region.

9. Other mammals

A large Long-haired Rat warren was recorded at Census Stop CL02.

E. REPTILES AND AMPHIBIANS

Very few reptiles were recorded during the survey, however lizard burrows were seen at most census stops. A probable snake scat was recorded at CL08 (photo page 105). Two species of skink were recorded at Coongie Lake while we were waiting for roads to dry. These were *Ctenotus regius*, Pale-rumped Ctenotus,

and *Ctenotus taeniatus*, Ribbon Ctenotus. *Ctenotus taeniatus*, Ribbon Ctenotus was also recorded at Census Stop CL07 (photo page 99).

F. INVERTEBRATES

There were 74 observations of insects and spiders recorded during the survey period which have been loaded to iNaturalist. Fifty of these observations were made at camp sites used during the survey period. A moth light was used on two evenings. Most observations have not had their identification confirmed.

Butterflies in the family *Lycaenidae* were recorded during the survey. These were *Lampides boeticus,* Long-tailed Pea-Blue and *Nacaduba biocellata*, Two-spotted Line-Blue, both recorded twice, and *Zizina otis* ssp. *labradus*, Common Grass Blue recorded once.

Moths were mainly recorded at night with 37 observations. These included *Utetheisa lotrix*, Crotalaria Moth, with only a few records from South Australia. The most frequently recorded moths were *Heliothis punctifera*, Lesser Budworm Moth, recorded both during the day and at night, and *Crypsiphona ocultaria*, Red-lined Looper.

Ants and wasps, *Hymenoptera*, beetles, *Coleoptera*, and bugs, *Hemiptera,* were recorded during the surveys.

Galls caused by *Apiomorpha floralis (Hemiptera)* were found on Coolibah trees along a flood channel at Census Stop CL07 (photo page 100). Corellas had been feeding on the insect larvae inside the gall.

Also recorded on the transects were the grasshoppers *Austracris guttulosa*, Spur-throated Locust, and *Cuparessa testacea,* and the dragonfly *Diplacodes bipunctata*, Wandering Percher.

Wolf spiders, *Lycosidae*, were recorded on the transects.

The recent flooding resulted in two species of mollusc being recorded at the census stops. Recently dry channels had the shells of freshwater mussels. At Census Stop CL10 there were many dead snail shells, probably *Isidorella newcombi* (photo page 111).

G. THREATS AND POTENTIAL IMPACTING FACTORS

1. Cattle grazing

Cattle grazing reduces the biomass of native plants across the Innamincka Regional Reserve and Coongie Lakes National Park. This reduces the resources available to native fauna. In addition, their trampling breaks the organic crust on the surface of these skeletal soils which increases wind and water erosion.

The Innamincka Station grazes cattle outside the Malkumba-Coongie National Park. During the survey we recorded the presence of cattle and their tracks at all census stops outside the National Park.

Cattle grazing is not permitted within the National Park however we recorded the presence of cattle at Census Stop 10 and to both the north and south of this area. Damage caused by cattle was mainly on the lower dune slopes and in wetland areas. There was heavy trampling and well-defined tracks in the Lignum wetlands.

The cattle presumably entered the park when the boundary fence has been damaged by flooding but had obviously been present in fairly high numbers for some time.

2. Weeds

The main sources of weeds in this area are flood waters from Cooper Creek bringing seeds and vegetation from further upstream and cattle being moved on to Innamincka Station. Weeds may also be transported along roads by vehicles and earth-moving machinery and by seeds attached to peoples clothing and camping equipment.

*Cenchrus ciliaris,*Buffel Grass, was recorded at Census Stop CL08 where transect D ran close to the road. Buffel Grass was plentiful at Kudriemitchie on the edge of the National Park and extended in both directions along the creek. It has probably been spread by flood waters, vehicles and associated campers and by cattle.

No other weeds were reported from the census stops. Other weeds possibly present at these locations are likely to be ephemeral herbs and other introduced grasses.

3. Feral animals

Feral animals present an on-gong threat to the flora and fauna.

The most numerous feral herbivores in the area are rabbits although other feral herbivores, including camels, horses, donkeys and omnivorous pigs are also causing damage. As well as reducing vegetation cover, feral herbivores cause increased erosion from their tracks and general trampling which damages the protective cryptogrammic crust. Their browsing also removes plant material which also leads to soil erosion. Rabbit warrens cause damage to the dunes, particularly in the northern part of the survey area. Feral pigs cause damage over large areas when rooting for tubers and subterranean invertebrates. Feral carnivores are limited to foxes and cats. Both these animals prey on small native mammals, reptiles, birds and invertebrates. Foxes only occur in low numbers in this area. Feral cats are present across the region and are regularly seen when travelling in the Innamincka Regional Reserve. Feral pigs will also feed on animals when the opportunity arises.

4. Mining, tourism and other human activity

The survey area outside the Malkumba-Coongie National Park is subject to oil and gas exploration and production. There are a few tracks leading to gas wells which are used regularly. Gas well infrastructure usually occupies a fairly small area. There is one gas well visible from Census Stop CL08. Buried pipelines also occur although the surface vegetation has largely recovered following their installation.

The Montepirie Track (Coongie Rd) is the main access to Malkumba-Coongie National Park and the only access available to the general public. There was very little rubbish found along the road during our survey or while driving between census stops.

Repeated grading of the road to create a hard, smooth surface has, in some places, lowered the road surface up to 1 metre below the surrounding countryside. This has resulted in water pooling on the road which remains for a considerable time following a rain event. At some of these points informal bypass tracks have been created and have caused damage to the vegetation and soil surface. Within the National Park the road is graded less often so is not cut down so deeply.

5. Fire

There was no evidence of recent fire recorded during the survey.

6. Soil erosion

The factors already mentioned above all contribute to soil erosion. Grazing by herbivorous animals reduces the vegetation cover and the ability of plants to hold the soil in place. Damage to the cryptogrammic crust also exposes the soil to increased wind and water erosion.

During the survey we found evidence of water erosion (gullies) along cattle tracks and vehicle tracks.

In this environment soil erosion, once started, will continue until it is halted by robust vegetation cover or by a pavement of gibber stones.

H. ARCHAEOLOGICAL SITES

The Cooper Creek flood plain is a biologically rich area that has supported people for thousands of years. Evidence of pre-European human activity was found at two of the census stops.

At Census Stop CL03 several broken grindstones were seen near corner point 2 (photo page 84).

At Census Stop CL05 stone flakes and a broken grindstone were found on an eroded sand slope on the face of a dune on transect A (photo page 90).

Both these locations were on the upper slopes of a dune within 1km of current water channels.

The locations have been reported to the rangers.

SUMMARY AND CONCLUSIONS

The repeat of the Montepirie (Coongie) Road survey was originally planned for July/August 2019 but was delayed due to road closures and the Covid-19 pandemic. The above average rainfall years of 2019 and 2021 along with average conditions in 2020 and 2022 had resulted in increased vegetation in the northerly parts of the survey area which in turn has allowed bird numbers to build up to around 2.5 times what was observed in 2014. There was also a 38% increase in the number of species recorded.

The increase in both number of species and number of individual birds was seen across all habitat types and across most guilds and species. Where declines were recorded these were mainly for uncommon local species or those in naturally low numbers where records are more opportunistic in nature.

The southern census stops showed the smallest changes in bird numbers. They also had poorer vegetation cover and more bare ground. This has been attributed to their geographic location, being closer to Innamincka Station where the area is subject to higher grazing pressure.

Cattle were observed within Malkumba-Coongie Lakes National Park. The comparison between the flood plains and the dunes was dramatic. The vegetation on the dunes was in poor condition. It showed the impacts of cattle and rabbits. Outside the survey area, along the southern shores of Coongie Lake, the dunes were almost devoid of vegetation and suffering from wind erosion. The flood plains, in contrast, still held some water but were suffering from cattle grazing with soil surfaces being disturbed and vegetation damaged. Some areas of the flood plain appeared to be suffering from salt damage. Bird numbers and species were generally low in the dune areas but were substantially higher on the flood plains and along the banks of Cooper Creek. This was the area where most water birds occurred.

While there was greater vegetation cover over much of the survey area it was noticeable that canopy density appeared to have decreased on the scattered Coolibah trees that were present across the area. There was also a loss of other woody vegetation in several areas.

The major threats to the natural environment in the vicinity of the census stops are grazing/browsing by cattle and feral animals. Evidence of most feral animals that are known to be in the region was recorded during the survey.

The most significant weed recorded was Buffel Grass. This occurred mainly along Cooper Creek and flood channels with a large infestation around Kudriemitchie outstation.

Human impacts were mainly from the oil and gas industry with their roads and pipelines which disrupted the flow of water across the landscape. There was very little litter found along the road.

While the increase in bird numbers at the time of this survey was positive there are concerns about the health of some of the vegetation and of the long-term environmental health of this region. This document, along with the other survey reports we have produced will hopefully provide data for future work that others may carry out.

APPENDIX I – LOCATION OF CENSUS STOPS

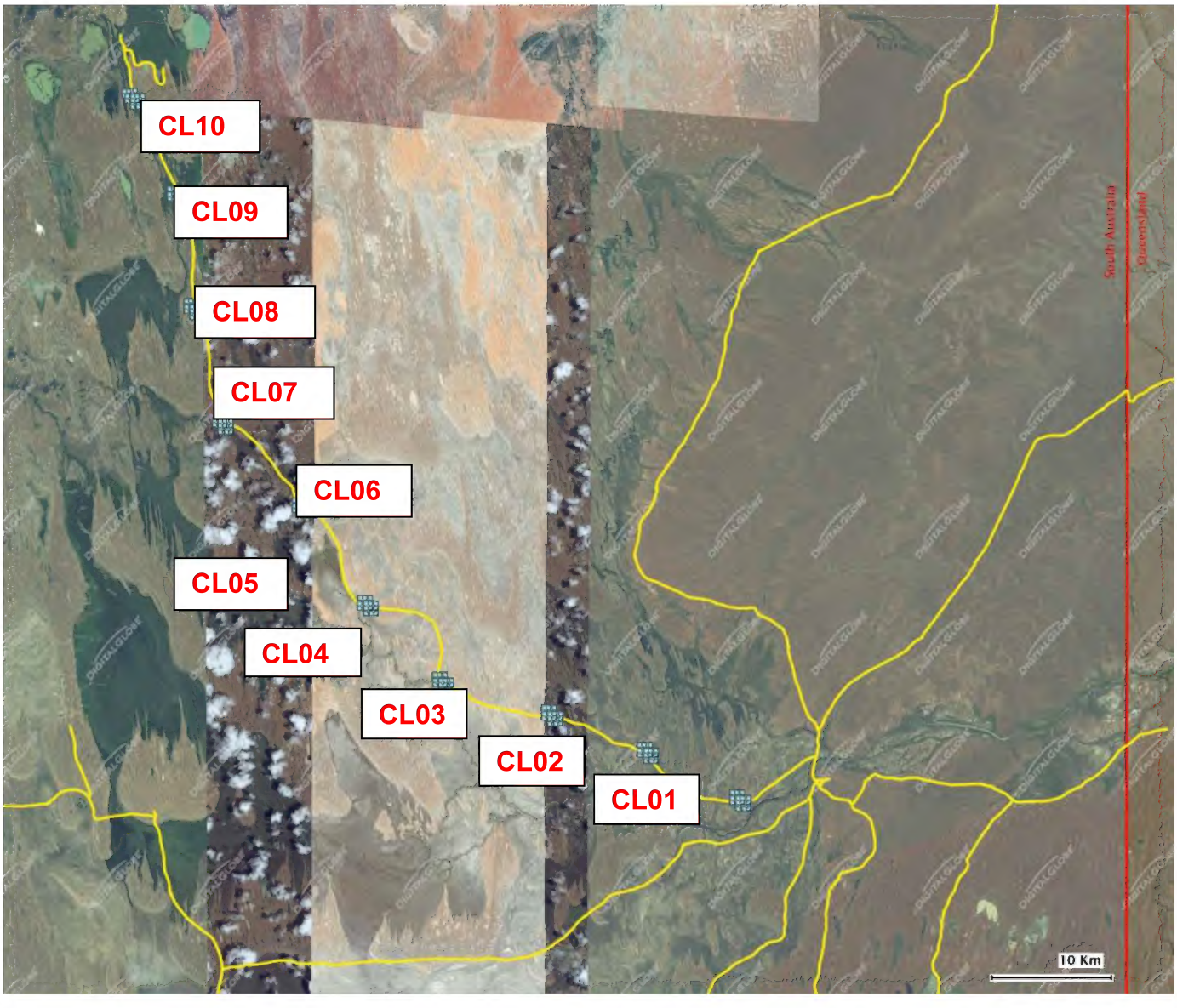
A. CENSUS STOP AND CORNER POINT CO-ORDINATES

The following table lists the co-ordinates recorded for each census stop for both the baseline 2014 survey and the repeat 2023 survey. The co-ordinate system used is UTM. The census stops are also shown on the following Map.

Census Stop	Corner Point	AMG zone	Easting	Northing
CL01	1	54J	0467629	6929506
	2	54J	0468136	6929506
	3	54J	0468136	6929006
	4	54J	0467629	6929006
	5	54J	0467129	6929504
	6	54J	0467130	6930005
	7	54J	0467630	6930006
CL02	1	54J	0459898	6933418
	2	54J	0460399	6933418
	3	54J	0460399	6932921
	4	54J	0459898	6932921
	5	54J	0459394	6933416
	6	54J	0459399	6933914
	7	54J	0459900	6933916
CL03	1	54J	0452003	6936480
	2	54J	0452507	6936487
	3	54J	0452507	6935981
	4	54J	0452007	6935981
	5	54J	0451506	6936480
	6	54J	0451505	6936978
	7	54J	0452004	6936979
CL04	1	54J	0442784	6939370
	2	54J	0443288	6939370
	3	54J	0443288	6938873
	4	54J	0442788	6938874
	5	54J	0442288	6939368
	6	54J	0442286	6939865
	7	54J	0442787	6939865
CL05	1	54J	0436454	6945757
	2	54J	0436954	6945758
	3	54J	0436953	6945259
	4	54J	0436454	6945258
	5	54J	0435950	6945756
	6	54J	0435974	6946240
	7	54J	0436473	6946242

Census Stop	Corner Point	AMG zone	Easting	Northing
CL06	1	54J	0431028	6953816
	2	54J	0431530	6953817
	3	54J	0431531	6953319
	4	54J	0431031	6953313
	5	54J	0430531	6953816
	6	54J	0430532	6954317
	7	54J	0431035	6954314
CL07	1	54J	0424294	6960834
	2	54J	0424792	6960834
	3	54J	0424793	6960337
	4	54J	0424292	6960334
	5	54J	0423794	6960834
	6	54J	0423794	6961334
	7	54J	0424294	6961334
CL08	1	54J	0421863	6970289
	2	54J	0422365	6970291
	3	54J	0422364	6969792
	4	54J	0421862	6969794
	5	54J	0421363	6970291
	6	54J	0421357	6970788
	7	54J	0421857	6970793
CL09	1	54J	0420405	6979622
	2	54J	0420905	6979625
	3	54J	0420905	6979126
	4	54J	0420404	6979126
	5	54J	0419902	6979626
	6	54J	0419903	6980126
	7	54J	0420404	6980126
CL10	1	54J	0416753	6987788
	2	54J	0417253	6987793
	3	54J	0417256	6987294
	4	54J	0416756	6987294
	5	54J	0416256	6987788
	6	54J	0416256	6988288
	7	54J	0416753	6988288

B. MAP SHOWING CENSUS STOP LOCATIONS ALONG THE COONGIE ROAD



Source: VantagePoint™/DigitalGlobe™ overlaid with FOIR census stop co-ordinates

APPENDIX II - BIRD SURVEY DATA
Combined data for all 8 transects at each census stop

Date and time	Census Stop	Species	Seen/ Heard	Number	GPS
27/07/2023	CL01	Australian Pelican	S	4	54 J
St. 10:10		Australian Raven	S	2	0467629E
Fin. 12:00		Black Honeyeater	S	1	6929506N
		Black Kite	S	2	
		Chestnut-rumped Thornbill	S	2	
		Chirruping Wedgebill	H	1	
		Red-rumped Parrot	S	2	
		Spiny-cheeked Honeyeater	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	S	1	
		White-winged Fairy-wren	H	2	
		White-winged Fairy-wren	H	2	
		White-winged Fairy-wren	H	2	
		Yellow-throated Miner	H	1	
				24	
27/07/2023	CL02	Australian Raven	S	2	54J
St. 13:00		Australian Raven	S	2	0459898E
Fin.14:30		Black-faced Woodswallow	S	13	6933418N
		Black-faced Woodswallow	S	1	
		Brown Treecreeper	S	2	
		Crested Pigeon	S	1	
		Crow/Raven Species	S	6	
		Crow/Raven Species	S	6	
		Eastern Bluebonnet	S	3	
		Galah	S	1	
		Galah	S	2	
		Galah	S	9	
		Little Crow	S	1	
		Little Crow	S	23	
		Magpie-Lark	S	2	
		Wedge-tailed Eagle	S	1	
		Wedge-tailed Eagle	S	1	
		Wedge-tailed Eagle	S	2	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		Yellow-throated Miner	S	1	
		Yellow-throated Miner	H	1	
		Yellow-throated Miner	H	2	
		Yellow-throated Miner	H	2	
		Yellow-throated Miner	H	2	
		Yellow-throated Miner	S	2	

		Yellow-throated Miner	S	4	
		Yellow-throated Miner	S	4	
		Yellow-throated Miner	S	11	
				110	

03/08/23	CL03	Australian Zebra Finch	H	1	54J
St. 13:10		Australian Zebra Finch	S	1	0452003E
Fin. 14:55		Australian Zebra Finch	S	3	6936480N
		Black-faced Woodswallow	S	3	
		Black-faced Woodswallow	S	5	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Cinnamon Quail-Thrush	S	1	
		Crested Pigeon	S	2	
		Crimson Chat	H	1	
		Crimson Chat	S	2	
		Crow/Raven Species	S	1	
		Crow/Raven Species	S	2	
		Crow/Raven Species	S	2	
		Inland Dotterel	S	2	
		Little Crow	S	2	
		Singing Honeyeater	H	1	
		Southern Whiteface	S	3	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	S	2	
		White-winged Fairy-wren	S	2	
		White-winged Fairy-wren	H	2	
				46	

29/07/23	CL04	Australian Magpie	S	1	54J
St. 10:33		Australian Magpie	S	1	0442784E
Fin. 12:15		Australian Pelican	S	54	6939370N
		Australian Raven	S	2	
		Australian Zebra Finch	H	1	
		Black Kite	S	4	
		Black Kite	S	6	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	H	1	
		Black-faced Woodswallow	S	5	
		Black-faced Woodswallow	S	6	
		Black-faced Woodswallow	S	6	
		Brown Falcon	S	1	
		Brown Treecreeper	H	1	

		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Crested Pigeon	S	1	
		Crested Pigeon	S	2	
		Crimson Chat	S	2	
		Galah	S	2	
		Galah	S	2	
		Little Corella	S	100	
		Little Corella	S	150	
		Little Crow	S	2	
		Little Crow	S	2	
		Little Crow	S	4	
		Little Crow	S	5	
		Little Eagle	S	1	
		Magpie-Lark	H	1	
		Mistletoebird	S	1	
		Red-browed Pardalote	H	1	
		Red-browed Pardalote	H	1	
		Red-browed Pardalote	H	1	
		Red-capped Robin	S	1	
		Red-capped Robin	S	1	
		Southern Whiteface	S	2	
		Whistling Kite	S	1	
		Whistling Kite	S	1	
		Whistling Kite	S	2	
		White-necked Heron	S	2	
		White-winged Fairy-wren	S	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	S	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	2	
		White-winged Fairy-wren	S	2	
		White-winged Fairy-wren	S	4	
		Willie Wagtail	S	1	
		Yellow-throated Miner	H	1	
		Yellow-throated Miner	S	2	
		Yellow-throated Miner	S	3	
		Yellow-throated Miner	H	5	
		Yellow-throated Miner	S	7	
				413	

03/08/23	CL05	Australian Raven	H	1	54J
St. 9:45		Australian Raven	S	2	0436454E
Fin. 11:40		Australian Raven	S	2	6945757N
		Australian Raven	S	2	
		Australian Raven	S	4	

		Australian Zebra Finch	H	1	
		Australian Zebra Finch	S	6	
		Australian Zebra Finch	S	6	
		Australian Zebra Finch	S	7	
		Australian Zebra Finch	S	8	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	S	2	
		Black-faced Woodswallow	S	7	
		Bourke's Parrot	S	1	
		Brown Treecreeper	S	1	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	S	1	
		Crested Pigeon	H	1	
		Crested Pigeon	S	1	
		Crested Pigeon	S	5	
		Crimson Chat	S	2	
		Diamond Dove	H	1	
		Galah	H	1	
		Galah	S	8	
		Galah	S	11	
		Horsfield's Bronze Cuckoo	H	1	
		Jacky Winter	S	1	
		Little Corella	S	2	
		Little Crow	H	1	
		Little Crow	S	1	
		Little Crow	S	2	
		Little Crow	S	3	
		Magpie-Lark	S	1	
		Red-browed Pardalote	H	1	
		Red-browed Pardalote	H	1	
		Red-browed Pardalote	H	2	
		Red-browed Pardalote	S	2	
		Red-capped Robin	S	1	
		Red-rumped Parrot	H	1	
		Rufous Songlark	S	1	
		Southern Whiteface	S	1	
		Spiny-cheeked Honeyeater	H	1	
		Tree Martin	S	3	
		Whistling Kite	S	1	
		Whistling Kite	S	2	
		White-plumed Honeyeater	H	1	
		White-plumed Honeyeater	H	1	
		White-plumed Honeyeater	S	1	
		White-plumed Honeyeater	H	4	
		White-plumed Honeyeater	S	4	
		White-plumed Honeyeater	S	4	

		White-plumed Honeyeater	S	7	
		White-winged Fairy-wren	S	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	S	1	
		White-winged Fairy-wren	H	2	
		White-winged Fairy-wren	S	2	
		White-winged Fairy-wren	S	3	
		Willie Wagtail	S	1	
		Yellow-throated Miner	S	1	
		Yellow-throated Miner	H	1	
		Yellow-throated Miner	H	1	
		Yellow-throated Miner	H	2	
		Yellow-throated Miner	S	2	
		Yellow-throated Miner	S	10	
				164	

02/08/23	CL06	Australian Zebra Finch	S	1	54J
St. 13:05		Australian Zebra Finch	H	1	0431028E
Fin. 15:00		Australian Zebra Finch	S	3	6953816N
		Australian Zebra Finch	S	4	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	S	4	
		Black-faced Woodswallow	S	9	
		Crested Pigeon	S	2	
		Crested Pigeon	S	2	
		Crested Pigeon	S	2	
		Crimson Chat	S	1	
		Eastern Bluebonnet	S	1	
		Eastern Bluebonnet	H	2	
		Galah	S	2	
		Galah	S	6	
		Galah	S	46	
		Horsfield's Bronze Cuckoo	H	1	
		Little Crow	H	1	
		Little Crow	S	1	
		Little Crow	S	7	
		Pied Honeyeater	H	1	
		Red-capped Robin	S	2	
		Red-capped Robin	S	3	
		Tree Martin	S	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	S	5	
		Yellow-throated Miner	H	1	
		Yellow-throated Miner	H	2	
		Yellow-throated Miner	S	2	
		Yellow-throated Miner	S	3	

		Yellow-throated Miner	H	3	
		Yellow-throated Miner	S	3	
		Yellow-throated Miner	S	4	
		Yellow-throated Miner	S	6	
		Yellow-throated Miner	S	6	
				142	

02/08/23	CL07	Australian Bustard	S	1	54J
St. 9:05		Australian Pelican	S	1	0424294E
Fin. 11.31		Australian Pelican	S	4	6960834N
		Australian Raven	S	1	
		Australian Raven	S	2	
		Australian Zebra Finch	H	1	
		Australian Zebra Finch	S	3	
		Australian Zebra Finch	S	5	
		Australian Zebra Finch	S	40	
		Black-faced Cuckooshrike	H	1	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	S	4	
		Black-faced Woodswallow	S	4	
		Bourke's Parrot	H	1	
		Bourke's Parrot	S	1	
		Brown Falcon	S	2	
		Brown Treecreeper	H	2	
		Chestnut-crowned Babbler	S	3	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	S	2	
		Cinnamon Quail-Thrush	H	1	
		Crested Pigeon	H	1	
		Crested Pigeon	S	1	
		Crested Pigeon	S	4	
		Galah	H	1	
		Galah	H	1	
		Galah	S	3	
		Galah	S	6	
		Grey Shrike-thrush	H	5	
		Horsfield's Bronze Cuckoo	S	1	
		Jacky Winter	H	1	
		Jacky Winter	H	1	
		Jacky Winter	H	1	
		Jacky Winter	S	2	
		Little Crow	S	1	
		Little Crow	S	6	
		Little Eagle	S	1	
		Magpie-Lark	H	1	
		Magpie-Lark	S	2	

		Magpie-Lark	S	3	
		Peaceful Dove	H	1	
		Peaceful Dove	H	1	
		Red-browed Pardalote	H	1	
		Red-browed Pardalote	H	1	
		Red-browed Pardalote	S	1	
		Red-capped Robin	H	1	
		Red-capped Robin	H	1	
		Red-capped Robin	S	1	
		Red-capped Robin	S	3	Feeding young
		Spiny-cheeked Honeyeater	H	1	
		Spiny-cheeked Honeyeater	S	1	
		Spiny-cheeked Honeyeater	H	1	
		Spiny-cheeked Honeyeater	H	1	
		Spiny-cheeked Honeyeater	S	4	
		Tree Martin	S	2	
		Tree Martin	S	2	
		Tree Martin	S	2	
		Tree Martin	S	3	
		Whistling Kite	S	1	
		White-backed Swallow	S	2	
		White-plumed Honeyeater	H	1	
		White-plumed Honeyeater	S	2	
		White-plumed Honeyeater	H	2	
		White-plumed Honeyeater	S	2	
		White-plumed Honeyeater	S	4	
		White-plumed Honeyeater	S	6	
		White-plumed Honeyeater	S	14	
		White-plumed Honeyeater	S	15	
		White-winged Fairy-wren	S	3	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	S	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	2	
		Willie Wagtail	H	1	
		Willie Wagtail	S	1	
		Willie Wagtail	S	1	
		Willie Wagtail	H	2	
				218	

29/07/23	CL08	Australian Pelican	S	3	54J
St. 14:35		Australian Pelican	S	87	0421863E
Fin. 16.17		Australian Zebra Finch	H	1	6970289N
		Australian Zebra Finch	H	3	

		Black Kite	S	2	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	S	4	
		Black-faced Woodswallow	S	8	
		Brolga	S	1	
		Brown Falcon	S	1	
		Brown Falcon	S	1	
		Brown Falcon	S	1	
		Brown Falcon	S	2	
		Crimson Chat	H	1	
		Crimson Chat	S	1	
		Galah	S	24	
		Little Corella	S	7	
		Little Crow	H	1	
		Little Crow	S	3	
		Little Crow	S	3	
		Little Crow	S	4	
		Little Crow	S	26	
		White-backed Swallow	S	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	2	
		Yellow-throated Miner	H	1	
				195	

01/08/23	CL09	Australian Pelican	S	1	54J
St. 14.35		Australian Pelican	S	9	0420405E
Fin. 16:34		Australian Raven	S	1	6979622N
		Australian Raven	S	1	
		Australian Zebra Finch	H	1	
		Australian Zebra Finch	S	1	
		Australian Zebra Finch	S	6	
		Australian Zebra Finch	S	6	
		Australian Zebra Finch	S	12	
		Black-eared Cuckoo	S	1	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	S	2	
		Black-faced Woodswallow	S	9	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Crested Pigeon	S	4	

		Crested Pigeon	S	6	
		Crow/Raven Species	S	2	
		Galah	S	7	
		Grey Shrike-thrush	S	1	
		Jacky Winter	S	2	
		Little Corella	S	2	
		Little Corella	S	2	
		Little Corella	S	38	
		Little Corella	S	100	
		Little Crow	S	1	
		Little Crow	S	2	
		Magpie-Lark	S	1	
		Magpie-Lark	S	1	
		Magpie-Lark	S	5	
		Peaceful Dove	S	1	
		Purple-backed Fairy-wren	H	1	
		Purple-backed Fairy-wren	S	2	
		Red-backed Kingfisher	S	1	
		Red-browed Pardalote	H	1	
		Red-rumped Parrot	S	6	
		Straw-necked Ibis	S	15	
		Tree Martin	S	1	
		Tree Martin	S	2	
		Whistling Kite	H	1	
		Whistling Kite	S	2	
		White-plumed Honeyeater	S	1	
		White-plumed Honeyeater	H	2	
		White-plumed Honeyeater	S	4	
		White-plumed Honeyeater	S	5	
		White-plumed Honeyeater	S	6	
		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	H	2	
		White-winged Fairy-wren	S	2	
		White-winged Fairy-wren	S	5	
		Willie Wagtail	S	1	
		Willie Wagtail	H	1	
		Yellow-throated Miner	H	1	
		Yellow-throated Miner	S	6	
				300	

01/08/23	CL10	Australasian Darter	H	1	54J
St. 9:30		Australasian Darter	S	2	0416753E
Fin. 11:20		Australasian Darter	S	2	6987788N
		Australian Pelican	S	3	
		Australian Pelican	S	6	
		Australian Pelican	S	19	
		Australian Pelican	S	26	
		Australian Pelican	S	40	

		Australian Pied Cormorant	S	1	
		Australian Pied Cormorant	S	3	
		Australian Raven	H	1	
		Australian Raven	S	1	
		Australian Raven	S	1	
		Australian Raven	S	2	
		Australian Zebra Finch	S	1	
		Australian Zebra Finch	S	5	
		Australian Zebra Finch	H	1	
		Australian Zebra Finch	S	10	
		Australian Zebra Finch	S	10	
		Black Kite	S	1	
		Black-faced Woodswallow	S	1	
		Black-faced Woodswallow	S	5	
		Black-fronted Dotterel	S	4	
		Chestnut Teal	S	1	
		Chirruping Wedgebill	S	1	
		Chirruping Wedgebill	H	1	
		Chirruping Wedgebill	H	1	
		Crested Pigeon	S	3	
		Eastern Bluebonnet	S	3	
		Great Cormorant	S	1	
		Grey Shrike-thrush	H	1	
		Little Corella	S	4	
		Little Crow	S	2	
		Little Crow	S	3	
		Magpie-Lark	S	1	
		Magpie-Lark	S	2	
		Maned Duck	S	2	
		Mistletoebird	S	1	
		Nankeen Kestrel	S	2	
		Red-browed Pardalote	H	1	
		Red-rumped Parrot	S	5	
		Spiny-cheeked Honeyeater	S	1	
		Spiny-cheeked Honeyeater	S	1	
		Tree Martin	S	8	
		Tree Martin	S	10	
		Tree Martin	S	10	
		Tree Martin	S	28	
		Whistling Kite	S	1	
		Whistling Kite	S	1	
		Whistling Kite	S	2	
		Whistling Kite	S	2	
		Whistling Kite	S	2	
		White-browed Woodswallow	S	2	
		White-plumed Honeyeater	H	1	
		White-plumed Honeyeater	S	4	
		White-plumed Honeyeater	S	8	

		White-winged Fairy-wren	H	1	
		White-winged Fairy-wren	S	1	
		White-winged Fairy-wren	S	1	
		White-winged Fairy-wren	S	1	
		White-winged Fairy-wren	S	2	
		White-winged Fairy-wren	S	2	
		White-winged Fairy-wren	S	2	
		White-winged Fairy-wren	S	3	
		Willie Wagtail	H	1	
		Willie Wagtail	H	1	
		Willie Wagtail	S	1	
		Willie Wagtail	S	1	
		Willie Wagtail	S	1	
		Willie Wagtail	S	1	
		Yellow-throated Miner	H	1	
		Yellow-throated Miner	H	2	
		Yellow-throated Miner	S	2	
		Yellow-throated Miner	S	2	
		Yellow-throated Miner	S	3	
		Yellow-throated Miner	S	4	
				295	

APPENDIX III – CORNER POINT PHOTOS: 2014 vs 2023

Census stop 1	2014	2023
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 1	2014	2023
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 1	2014	2023
Corner point 5		
Right (to centre of western quadrant)	No Photo	
Left (away from western quadrant)	No Photo	
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 1	**2014**	**2023**
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 2	2014	2023
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 2	2014	2023
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 2	2014	2023
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)	No Photo	
Left (away from western quadrant)	No Photo	

Census stop 2	2014	2023
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 3	2014	2023
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 3	2014	2023
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 3	2014	2023
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 3	**2014**	**2023**
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 4	2014	2023
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 4	2014	2023
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 4	2014	2023
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 4	**2014**	**2023**
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 5	2014	2023
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 5	2014	2023
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 5	2014	2023
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 5	2014	2023
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 6	2014	2023
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 6	2014	2023
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 6	2014	2023
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 6	2014	2023
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 7	2014	2023
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 7	2014	2023
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 7	2014	2023
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 7	2014	2023
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 8	2014	2023
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 8	2014	2023
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 8	2014	2023
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 8	2014	2023
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 9	2014	2023
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 9	2014	2023
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 9	2014	2023
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 9	2014	2023
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Census stop 10	2014	2023
Corner point 1		
Right (to centre of eastern quadrant)		
Left (to centre of western quadrant)		
Corner point 2		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 10	2014	2023
Corner point 3		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		
Corner point 4		
Right (to centre of eastern quadrant)		
Left (away from eastern quadrant)		

Census stop 10	2014	2023
Corner point 5		
Right (to centre of western quadrant)		
Left (away from western quadrant)		
Corner point 6		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

Corner point 6 co-ordinates were incorrectly recorded in 1st survey

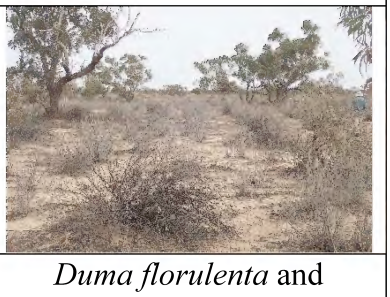
Census stop 10	2014	2023
Corner point 7		
Right (to centre of western quadrant)		
Left (away from western quadrant)		

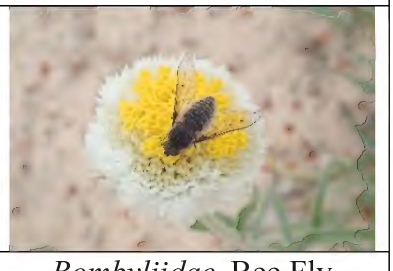
APPENDIX IV - PHOTOGRAPHIC AND HABITAT RECORDS

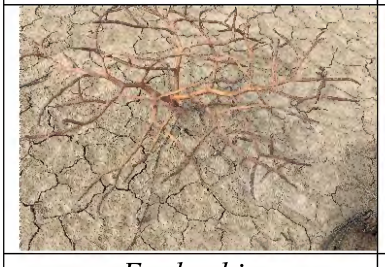
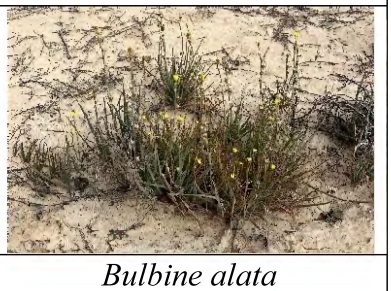
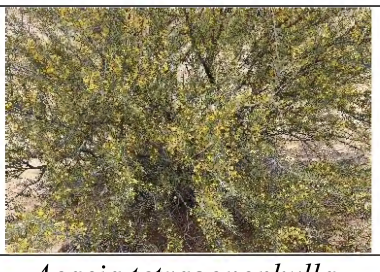
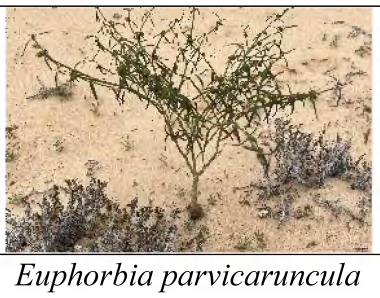
The following photos do not include the corner point photos as these are already presented in Appendix III

Census stop: CL01 Date: 27/07/2023 Start time: 10:10
Weather: 23ºC. 60% cloud, Wind: North-east 22 km per hour.
Number of observers: 9 (2 groups of 4 or 5)
Habitat: Tussock grassland, sparse woodland

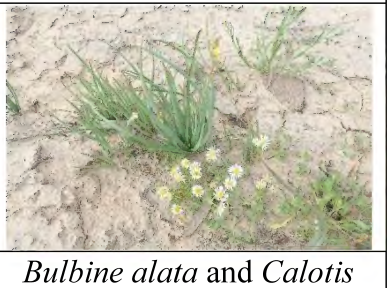
Transect A	Habitat: Sand plain and clay pan with sparse vegetation	
Owenia acidula, Emu Apple	*Eremophila maculata*, Spotted Emu Bush	Acacia shrubs, sparse herbs
Well vegetated sand plain with *Eucalyptus coolabah*	*Bulbine alata*	*Duma florulenta,* Tangled Lignum
Chenopodium auricomum, Golden Goosefoot	*Swainsona sp.*	Old cattle track on clay pan.
Eremophila maculata, Spotted Emu Bush		

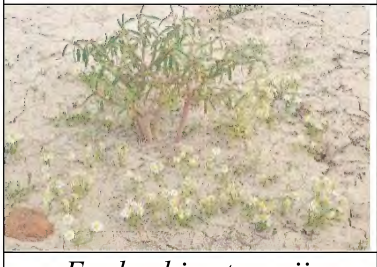
Transect B	Habitat: Scattered Coolibah, many dead. 20% vegetation cover	
Eucalyptus coolabah	*Podaxis pistillaris*, Desert Shaggymane	Sand plain with patchy vegetation
Poecilometis sp.	Lizard hole	*Calotis plumulifera,* Woolly-headed Burr-Daisy
Lepidoptera larva on dead daisy.		
Transect C	Habitat: Clay pan with scattered vegetation. Cover 10%	
		
Sand plain near fence line.	Vehicle tracks on clay pan	*Duma florulenta* and *Eucalyptus coolabah*
Kangaroo scats	*Calotis plumulifera*, Woolly-headed Burr-Daisy	*Bulbine alata*

Transect D	Habitat: Clay pan with Lignum and Coolibah	
Teucrium racemosum, Grey Germander	*Bulbine alata*	*Eremophila maculata*, Spotted Emu Bush
Goodenia sp.	*Eremophila bignoniiflora*, Bignonia Emu-Bush	*Chenopodium auricomum,* Golden Goosefoot
		
Lysiphyllum gilvum, Native Bauhinia	*Senecio gregorii*, Fleshy Groundsel	*Bombyliidae,* Bee Fly
Crinum flaccidum, Darling Lily		
Transect E	Habitat: Undulating sand plain, 20% vegetation cover	
Kangaroo scats	Lizard burrow	Acacia on sandy rise

Senecio gregorii, Fleshy Groundsel and saltbush		
Transect F	Habitat: Sand plain, few small treess. 30% ground cover.	
		
Euphorbia parvicaruncula	Sand plain with sparse vegetation	*Bulbine alata*
Transect G	Habitat: Undulating sand plain. 15% cover	
		
Acacia victoriae, Gundabluie	*Acacia tetragonophylla,* Dead Finish	Sandy Rise
Sandy rise with *Senecio gregorii*	Cat scat?	
Transect H	Habitat: Undulating sand plain. 20% cover	
		
Senecio gregorii and *Lepidium sp.*	*Euphorbia parvicaruncula*	

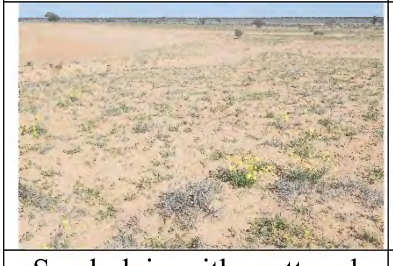
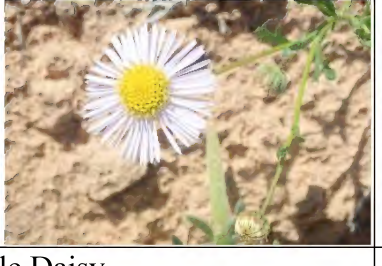
Census stop: CL02 Date: 27/07/2023 Start time: 13:00
Weather: 26ºC. 90% high cloud, Wind: North-east 13km per hour.
Number of observers: 9 (2 groups of 4 or 5)
Habitat: Sand and clay plains with saltbush and scattered Coolibah trees

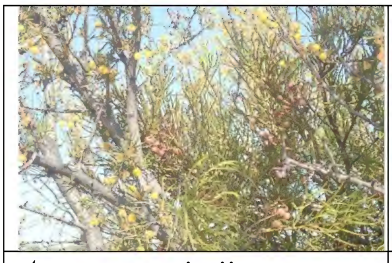
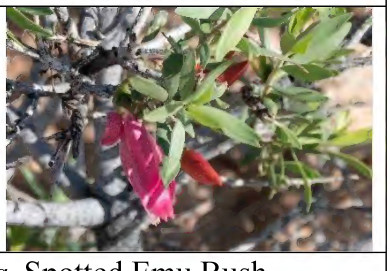
Transect A	Habitat: Clay plain with saltbush. 30% cover	
Sparse saltbush	*Tripogonella loliiformis*, Five Minute Grass	Galah
		
Euphorbia stevenii, Caustic Bottletree	*Iridomyrmex viridiaeneus*, Centralian Meat Ant	*Bulbine alata* and *Calotis plumulifera*, Woolly-headed Burr-Daisy
Cattle track on clay plain		
Transect B	Habitat: Sand/clay plain with saltbush and scattered Coolibah. 30% cover	
Duma florulenta, Tangled Lignum	*Rhodanthe troedelii*	A variety of small herbs in a gilgai

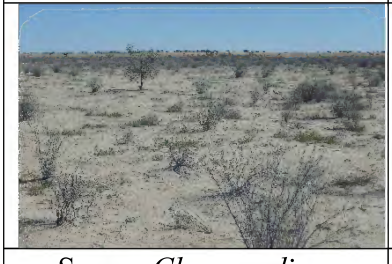
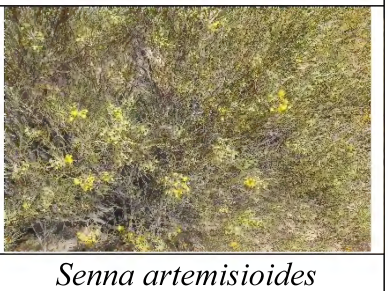
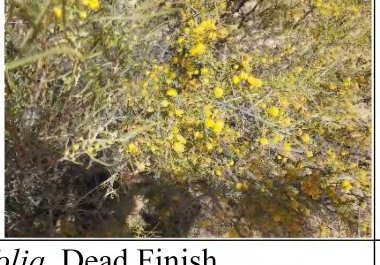
Eucalyptus coolabah	*Eucalyptus coolabah* with saltbush understory	*Iridomyrmex viridiaeneus*, Centralian Meat Ant
Transect C	Habitat: Sand/clay/gibber plain with saltbush and *Eremophila.* 30% cover	
		
Euphorbia stevenii, Caustic Bottletree and *Calotis plumulifera*, Woolly-headed Burr-Daisy	*Lysiana subfalcata,* Northern Mistletoe	
Transect D	Habitat: Sand plain. 30% cover	
	The spider has created a silk-lined tunnel with a trapdoor (left). Subsequent rain has eroded the clay to leave the entrance above the surrounding surface.	
Spider tunnel		
Transect E	Habitat: Flood plain with Coolibah and saltbush. 30% cover	
	-	
Eucalyptus coolabah with *Chenopodium auricomum,* Golden Goosefoot		
Transect F	Habitat: Sand plain with small shrubs and ephemeral herbs. 50% cover	
No photos		

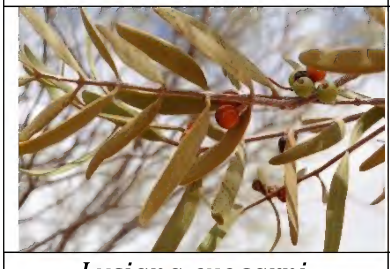
Transect G	Habitat: Undulating sand plain. Ephemeral creek. 30% cover	
Canegrass on the flood plain		
Transect H	Habitat: Flood plain	
Sand plain with *Eucalyptus coolabah*	Ephemeral herbs on flood plain.	

Census stop: CL03 Date: 03/08/2023 Start time: 13:10
Weather: 31°C. 10% cloud. Wind Northerly, 7 kph.
Number of observers: 9 (2 groups of 4 or 5)
Habitat: Sand plain with some sheet erosion. Tussock grassland.

Transect A	Habitat: Sand plain with some sheet erosion. 50% cover	
Eroded sand plain	*Bulbine alata*	*Gnephosis eriocarpa*
		
Sand plain with scattered herbs	*Euphorbia parvicaruncula*	*Senna artemisioides*
		
Brachyscome ciliaris, Variable Daisy		*Amyema preissii*
Sandy rise with Acacia and Senna spp.	Part of grindstone	
Transect B	Habitat Undulating sand plain with scattered Acacia. 40% cover	
Atriplex holocarpa, Pop Saltbush	*Hakea leucoptera,* Silver Needlewood	*Acacia tetragonofolia* with *Amyema preissii*

		
Amyema preissii	Well vegetated sand plain showing small erosion gully	*Gnephosis eriocarpa*
Eucalyptus coolabah and *Hakea leucoptera* on ridge. Montepirie Track	Emu track	
Transect C	Habitat: Sand plain with sheet erosion. Scattered Hakea. 40% cover	
		
Senecio lautus/glaucophyllus complex	*Eremophila maculata,* Spotted Emu Bush	
Dingo skull	Sand plain	Herbs on sand plain
Rhodanthe troedelii	*Euphorbia stevenii*, Caustic Bottletree	

Transect D	Habitat: Clay pan with gilgai containing vegetation. 20% cover	
Bulbine alata and *Goodenia sp.*		
Transect E	Habitat: Sand/clay plain with scattered Hakea. 30% cover	
		
Sparse *Chenopodium auricomum* on clay pan	*Bulbine alata*	Kangaroo scat
Transect F	Habitat: Clay plain with sparse Golden Goosefoot and Coolibah	
Sparse *Chenopodium auricomum* on clay pan	*Bulbine alata*	
Transect G	Habitat: Sand plain and low dune. 10% cover	
		
Rhodanthe moschata, Musk Sunray	*Senecio gregorii*	*Senna artemisioides*
		
Acacia tetragonofolia, Dead Finish		*Maireana appressa*, Grey Bluebush

Sand plain with Acacia and Hakea	Vegetated sand plain	
Transect H	Habitat: Sandy rise with Senna, Sclerolaena and grasses. Cover 40%	
		
Lysiana exocarpi, Harlequin Mistletoe		

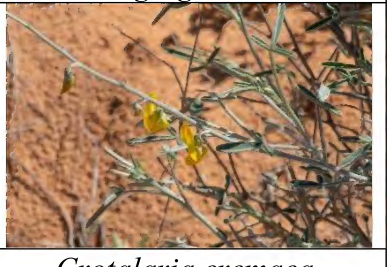
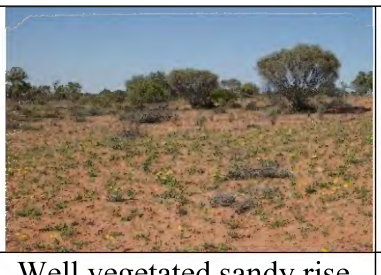
Census stop: CL04 Date: 29/07/2023 Start time: 10:30
Weather: 25°C. 30% cloud, Wind: Northerly 11kph.
Number of observers: 9 (2 groups of 4 or 5)
Habitat: Sand plain with open Coolibah woodland.

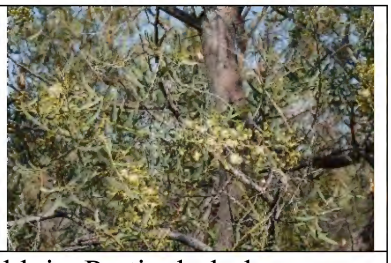
Transect A	Habitat: Sand plain, scattered Coolibah and Acacia 30% cover	
Eucalyptus coolabah	*Eucalyptus coolabah*	*Crinum flaccidum*, Darling Lily
Transect B	Habitat: Sand plain with scattered Coolibah. 30% cover	
Cattle track, *Chenopodium auricomum* and *Eucalyptus coolabah*	Raised entrance to spider burrow. Note cap in lower right.	*Eucalyptus coolabah*
Saltbush along edge of road	Clay plain with cattle tracks and scats	
Transect C	Habitat: Sand plain, scattered Coolibah. 30% cover	
Eucalyptus coolabah		

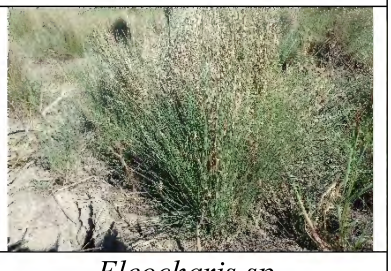
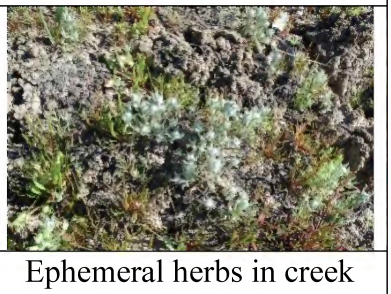
Transect D	Habitat: Sand plain, scattered Coolibah. 30% cover	
Chenopodium auricomum and *Eucalyptus coolabah*	*Eremophila maculata,* Spotted Emu Bush	Cattle track
Sand plain with *Eucalyptus coolabah* woodland.		
Transect E	Habitat: Sand plain with tussock grasses. 30% cover	
Sand plain with *Eucalyptus coolabah*		
Transect F	Habitat: Sand plain with scattered trees. 40% cover	
Grevillea striata, Beefwood		
Transect G	Habitat: Sand plain with Beefwood, Senna. 30% cover	
Sand plain with riparian woodland in distance.		
Transect H	Habitat: Sand plain and low dunes.	
No Photos		

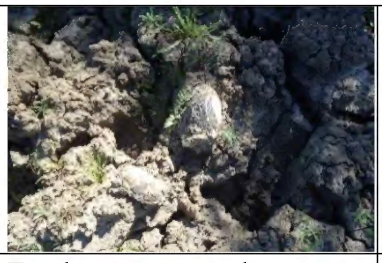
Census stop: CL05 Date: 03/08/2023 Start time: 09:45
Weather: 0% cloud, Temp: 25C Wind: North-east, 11kph.
Number of observers: 9 (2 groups of 4 or 5)
Habitat: Undulating sand plain with scattered trees and clay pans.

Transect A	Habitat: Sand plain with Hakea and Coolibah. 40% cover	
Blennodia canescens	*Atriplex holocarpa,* Pop Saltbush	Dune slope with old vehicle track and erosion
Part of grindstone	Worked stone	*Goodenia sp.*
Acacia victoriae, Gundabluey	*Hakea leucoptera,* Silver Needlewood	*Senecio gregorii*
Sand plain with herbaceous vegetation. Hakea and Coolibah in background.	*Polycalymma stuartii,* Poached Egg Daisy	*Swainsona sp.*
Bulbine alata	Sand plain	*Crotalaria eremaea*, Bluebush Pea

Transect B	Habitat: Sand plain with good cover of forbs. Cover 70%	
Lizard burrow	*Fimbristylis dichotoma,* Common Fringe-Rush	
Lizard burrow and ephemeral saltbush	*Crinum flaccidum*, Darling Lily	*Nicotiana velutina,* Velvet Tobacco and *Senecio gregorii*
		
Swainsona sp.	Termite mound	*Crotalaria eremaea*, Bluebush Pea
Transect C	Habitat: Hakea woodland with tall *Acacia victoriae*. 50% cover.	
		
Acacia victoriae	Well vegetated sandy rise	*Glycine canescens,* Silky Glycine
Roepera sp. Twinleaf	Zebra Finch nest	Bourke's Parrot

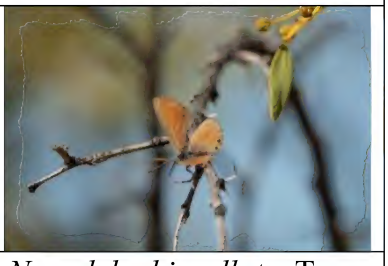
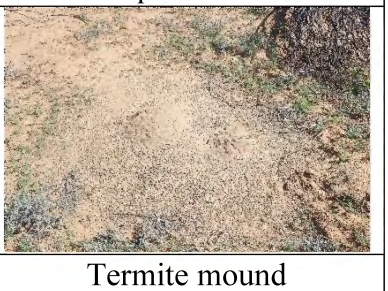
		
Acacia tetragonofolia, Dead Finish	*Acacia victoriae,* Gundabluie. Particularly large specimens for this region.	
Enchylaena tomentosa, Barrier Saltbush		
Rabbit warren	Raven tracks	*Iridomyrmex viridiaeneus*
Maireana appressa, Grey Bluebush		
Transect D	Habitat: Lignum/Goosefoot flood plain with scattered Coolibah.	
Cattle track showing plant germination where water gathers.	*Calotis plumulifera*, Woolly-headed Burr-Daisy	*Tripogonella loliiformis,* Five Minute Grass

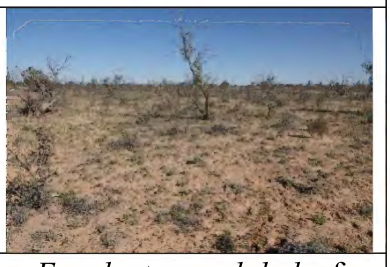
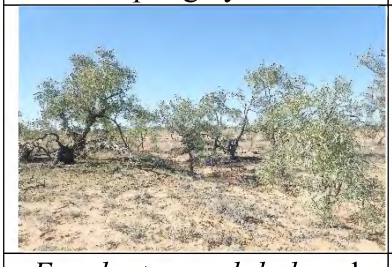
Transect E	Habitat: Lignum/Goosefoot flood plain with scattered Coolibah.	
Rhodanthe troedelii	*Calotis hispidula,* Hairy Burr-Daisy, Bogan Flea	Flood plain with Golden Goosefoot.
Austracris guttulosa, Spur-throated Locust	Herbs on wet areas of flood plain	
Transect F	Habitat: Flood plain with dry river channels. 40% cover	
		
Complex *Senecio lautus*, *Senecio Glaucophyllus* Complex	*Eucalyptus coolabah* along a creek channel.	*Eleocharis sp.*
		
Cracking clay soils in creek channel	*Ludwigia peploides,* Floating Primrose-Willow	Ephemeral herbs in creek channel.
Creek channel lined with Lignum and Coolibah	*Sonchus asper,* Prickly Sowthistle	*Thyridia repens,* Creeping Monkey Flower

		
Yabby skeleton	Freshwater mussels	*Myosurus minimus,* Mouse-tail
Transect G	Habitat: Damp clay plain with cracking gilgai. Coolibah and Lignum. Cover 40%	
Goodenia sp.		
Transect H	Habitat: Sand flat with Golden Goosefoot, Lignum and scattered Coolibah. 30% cover	
Open Lignum wetland	*Tetragonia sp*. and *Salsola kali.*	*Bulbine alata*
Sclerolaena bicornis, Goathead Burr		

Census stop: CL06 Date: 02/08/2023 Start time: 13:08

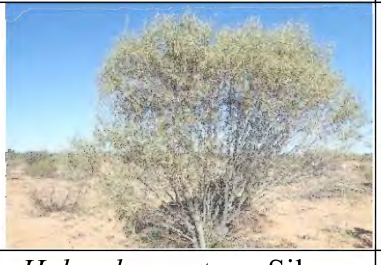
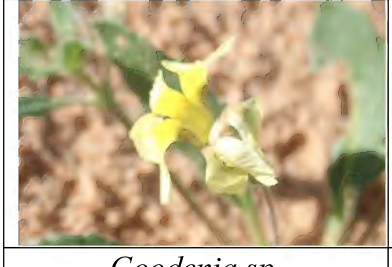
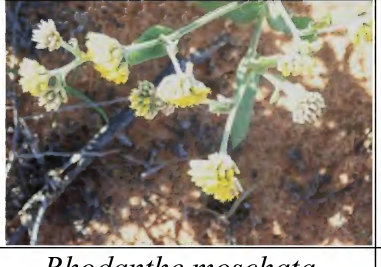
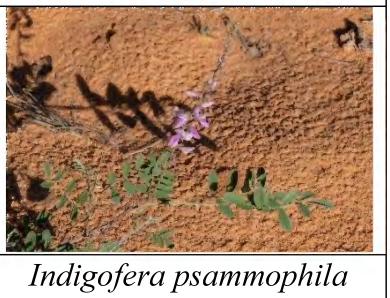
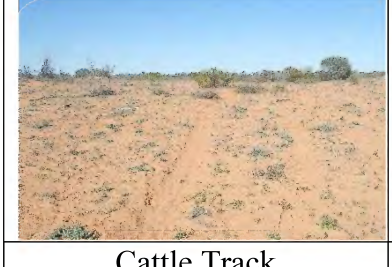
Weather: 0% cloud, 25C, Wind: Easterly, 8kph
Number of observers: 9 (2 groups of 4 or 5)
Habitat: Undulating sand plain with Whitewood, Coolibah and *Acacia spp*.

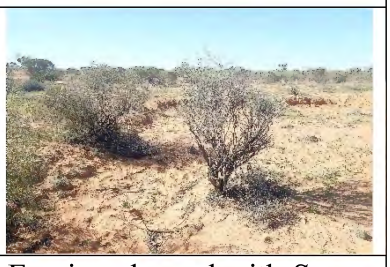
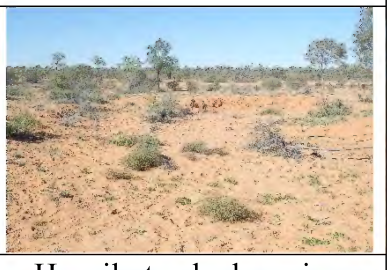
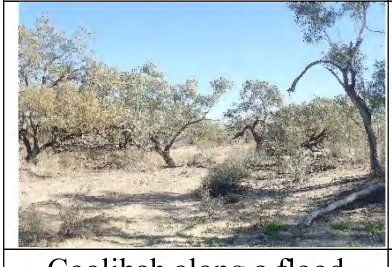
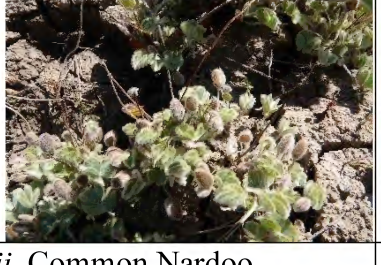
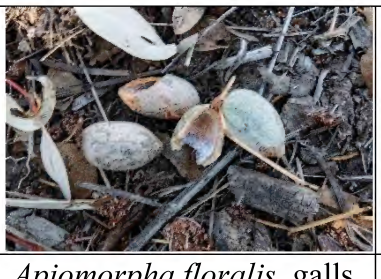
Transect A	Habitat: Whitewood and Acacia with understory of saltbush. Some sheet erosion. 60% cover	
		
Sand plain with *Acacia spp.*	*Gnephosis eriocarpa*	*Nacaduba biocellata,* Two-spotted Line-Blue
Transect B	Habitat: Moderate cover of *Acacia spp*. 50% cover	
Sand plain with tall Acacia. Many cattle prints.	Lizard burrow	*Lysiana exocarpi,* Harlequin Mistletoe
		
Acacia tetragonofolia, Dead Finish. Very old shrubs to 10m high.		Termite mound
Cattle bones	*Calotis plumulifera,* Woolly-headed Burr-Daisy	

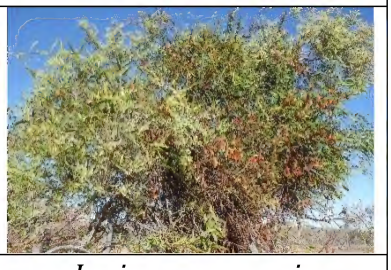
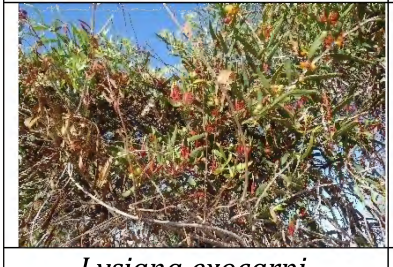
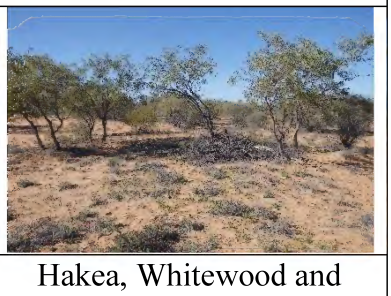
Transect C	Habitat: Sand plain with saltbush, *Acacia spp*. and Whitewood. 70% cover	
		
Sand plain with moderate trampling by cattle	Termite mound	*Eucalyptus coolabah* of various ages.
		
Eucalyptus coolabah and *Atalaya hemiglauca,* Whitewood	Ephemeral herbs	*Eucalyptus coolabah* with heavy cattle use
Clay pan.		
Transect D	Habitat: Sand plain with sheet erosion. 30% cover	
Clay pan with herbs in wet hollows	*Bulbine alata* dominates in a wet hollow	Old survey marker – “DSS 94 FEM STN 456”
Water channel on clay pan. *Eucalyptus coolabah*.		

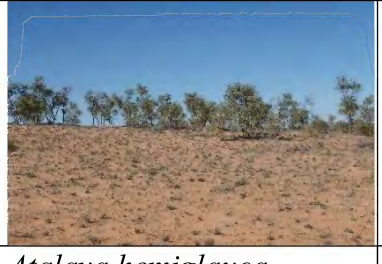
Transect E	Habitat: Low dune and sand plain with scattered Coolibah and Whitewood.	
Clay pan with dead cane-grass		
Transect F	Habitat: Sand plain with Whitewood and Sclerolaena. 50% cover.	
Galahs in *Lysiphyllum gilvum*, Native Bauhinia	*Eucalyptus coolabah* and *Atalaya hemiglauca,* Whitewood	
Transect G	Habitat: Clay pan with dead cane-grass and scattered small trees. 40% cover	
Clay pan with dead cane-grass	Vegetated sand flats and clay pan	
Transect H	Habitat: Sand plain with scattered Coolibah, Whitewood, Senna and Acacia. 30% cover	
Sand plain with scattered trees.		

Census stop: CL07 Date: 02/08/2023 Start time: 09:05
Weather: 0% cloud, 16C, Wind: 10kph, southerly
Number of observers: 9 (2 groups of 4 or 5)
Habitat: Sand plain with low dunes and shrubs.

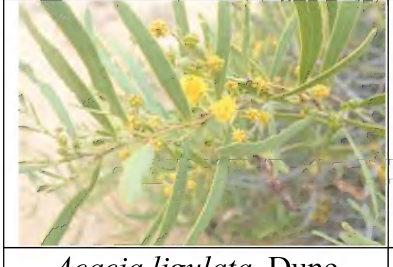
Transect A	Habitat: Sand plain with Hakea and *Acacia spp*. 40% cover.	
Acacia victoriae, Gundabluie		*Acacia ligulata*, Dune Wattle
		
Ctenotus taeniatus, Ribbon Ctenotus	*Hakea leucoptera,* Silver Needlewood	*Harmsiodoxa puberula*, Scented Cress
		
Goodenia sp.	*Rhodanthe moschata*, Musk Sunray	Lizard burrow
		
Acacia and Whitewood. Large ant nest.	*Iridomyrmex purpureus,* Southern Meat Ant	*Indigofera psammophila*
		
Cattle Track	*Sclerolaena bicornis,* Goathead Burr	

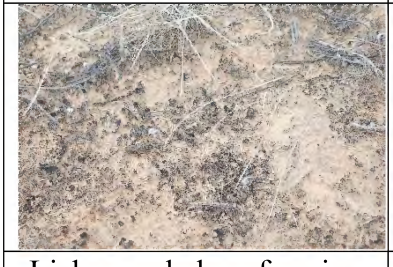
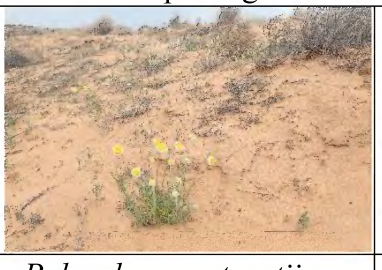
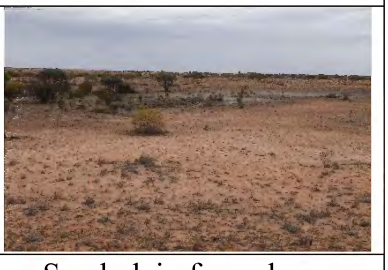
Transect B	Habitat: Sand plain with low dunes. Heavily browsed Acacia and Senna. 50% cover	
		
Low dune with Acacia. Remains of larger trees/shrubs.	Horse/donkey scats	Erosion channel with *Senna artimisioides*.
		
Grevillea striata, Beefwood		Heavily tracked erosion channel.
Transect C	Habitat: Open Coolibah woodlands – flood plain. Saltbush and Lignum. 20% cover.	
		
Coolibah along a flood channel.	*Leiocarpa leptolepis,* Stalked Plover-Daisy	*Ixiochlamys cuneifolia,* Silverton Daisy
		
Marsilea drummondii, Common Nardoo		
Transect D	Habitat: Coolibah woodland with channels. Lignum. 80% cover.	
		
Eucalyptus coolabah with *Duma florulenta* understory	*Apiomorpha floralis,* galls on Coolibah	Damp Coolibah lined flood channel with dense Nardoo.

Coolibah with large mistletoe.	*Amyema preissii*	
Transect E	Habitat: Flood plain with coolibah. 40% cover	
		
Old fence line.	Raven or magpie nest in wattle.	*Lysiana exocarpi,* Harlequin Mistletoe
		
Lysiana exocarpi, Harlequin Mistletoe	Surface water following recent rain	*Eremophila bignoniiflora*, Bignonia Emu-Bush
Transect F	Habitat: Undulating sand plain with Coolibah, tall shrubs and Sclerolaena. 50% cover	
		
Acacia and *Eremophila.* Creek line in distance.	Camel tracks	Hakea, Whitewood and Senna on sandy rise.
Sand flat with area subject to inundation.		

Transect G	Habitat: Undulating sand plain and clay pan. 60% cover	
Surface water following recent rain	*Acacia ligulata*, Dune Wattle	Fresh Sclerolaena growth in swale
Transect H	Habitat: Low dune and sand plain with medium shrub cover. 40% cover	
Face of low dune.	Dune crest; cane-grass, *Crotalaria sp*. and herbs	*Indigofera psammophila*
		
Old cattle yard serves as an informal exclusion plot	*Atalaya hemiglauca,* Whitewood, on dune crest	

Census stop: CL08 Date: 29/07/2023 Start time: 14:35
Weather: Moderate wind, 90% cloud, 23C, Wind 10kph
Number of observers: 9 (2 groups of 4 or 5)
Habitat: Low dunes with Whitewood and Hakea.

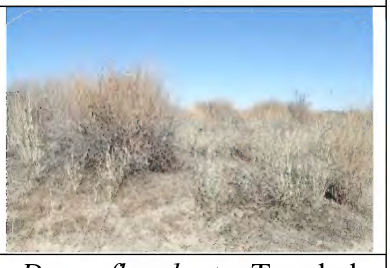
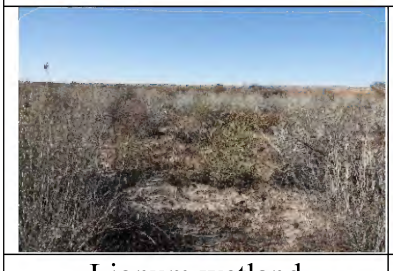
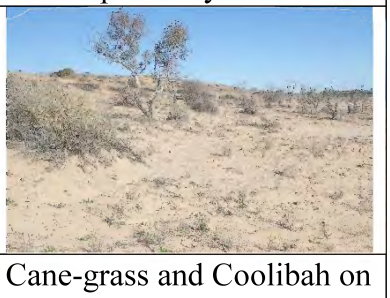
Transect A	Habitat: Low dunes with small trees and Sclerolaena. 40% cover	
Glycine canescens, Silky Glycine	*Scaevola parvibarbata,* Small-beard Fanflower	Whitewood and Acacia on dune slope.
Erosion gully with Whitewood.	Old fence line.	Cat scats.
		
Acacia ligulata, Dune Wattle	Kangaroo scat	*Polycalymma stuartii,* Poached Egg Daisy
Salsola australis, Australian Tumbleweed	*Diplacodes bipunctata,* Wandering Percher	*Atalaya hemiglauca,* Whitewood
Swainsona sp.		

Transect B	Habitat: Low dunes with small trees and Sclerolaena. 40% cover	
Duma florulenta, Lignum wetland.	Lizard burrow	*Ptilotus polystachyus,* Prince of Wales Feather
Transect C	Habitat: Low dunes with small trees and Sclerolaena. Well-developed algal crust. 40% cover	
		
Lichen and algae forming a surface crust.	*Polycalymma stuartii* on dune slope	Sand plain from dune. Ephemeral wetland with Scaevola in middle distance.
Lizard burrow.	Ants feeding on dead earthworm	*Scaevola depauperata,* Skeleton Fanflower
Nicotiana velutina, Velvet Tobacco	*Harmsiodoxa puberula*, Scented Cress and *Rhodanthe moschata*, Musk Sunray	*Hakea leucoptera,* silver Needlewood. Cattle tracks in foreground.
Senecio gregorii	*Enchylaena tomentosa*, Barrier Saltbush	*Enneapogon avenaceus,* Common Bottle-Washers

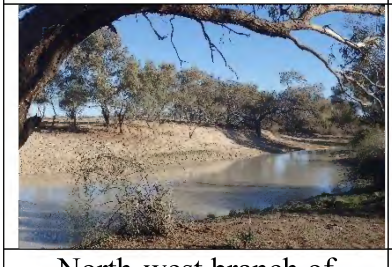
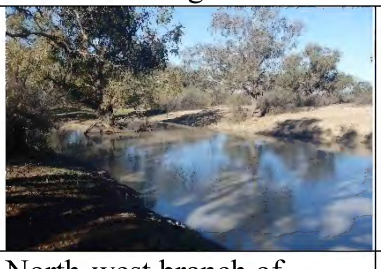
Lycoperdaceae, Puffballs		
Transect D	Habitat: Sand plain with scattered Whitewood and Hakea. 30% cover	
Snake scat	*Cenchrus ciliaris,* Buffel Grass in shelter of dead saltbush	*Brachyscome ciliaris,* Variable Daisy
Hakea leucoptera, Silver Needlewood		
Transect E	Habitat: Sand plain with low dunes. 40% cover.	
Zygochloa paradoxa, Sandhill Cane-grass on dune.		
Transect F	Habitat: Sandhill Cane-grass on dune. 40% cover	
Indigofera psammophila		

Transect G	Habitat: Undulating sand plain with scattered Acacia. 30% cover	
Rabbit warren	*Triodia basedowii,* Hard Spinifex	
Transect H	Habitat: Hummock grassland with scattered Acacia. 35% cover.	
Dead Hakea with cane-grass and Acacia.	Old fenceline.	

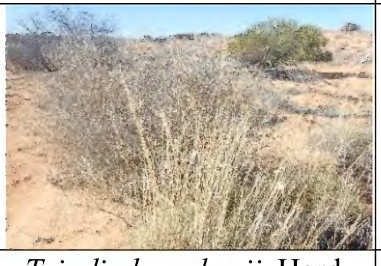
Census stop: CL09 Date: 01/08/2023 Start time: 14:35
Weather: 0% cloud, 27C, Wind: 8kph, SE
Number of observers: 9 (2 groups of 4 or 5)
Habitat: Flood plain with lignum and some low dunes.

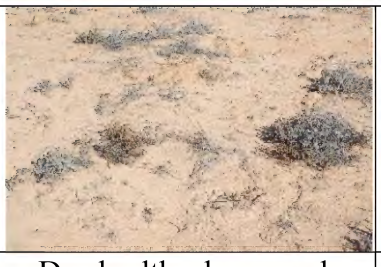
Transect A	Habitat: Overflow wetland with lignum. Recent cattle damage.	
		
Fresh cattle tracks and scats across the wetland		*Duma florulenta,* Tangled Lignum
		
Lignum wetland	*Enchylaena tomentosa,* Barrier Saltbush	Lignum wetland
Epaltes cunninghamii	Freshwater mussel shell	*Frankenia foliosa,* Leafy Sea-Heath
Transect B	Habitat: Low dune with cane-grass and scattered trees. 30% cover	
Part of grindstone	Coolibah on area of sheet erosion.	Dune with cane-grass, flood plain beyond.
		
Polycalymma stuartii, Poached Egg Daisy	*Senecio gregorii*	Cane-grass and Coolibah on dune slope.

Worked stone flakes	*Zizina otis*, Common Grass-Blue	
Transect C	Habitat: Sand plain with saltbush and scattered Coolibah. Cattle damage. 25% cover	
Flood plain with saltbush.	Flood channel, *Duma florulenta* and *Eucalyptus camaldulensis* and *E. coolabah*	
Transect D	Habitat: Clay flood plain with scattered lignum and dead Coolibah. 10% cover	
Clay pan with heavy trampling by cattle.		
Transect E	Habitat: Degraded lignum flood plain. 40% cover	
Lignum wetland	Low dune with Coolibah beside the flood plain	Clay pan with puddle from recent rain. Coolibah on dune.

Transect F	Habitat: Flood plain with scattered lignum. 40% cover.	
Duma florulenta, Tangled Lignum	*Enchylaena tomentosa,* Barrier Saltbush	
Transect G	Habitat: Lignum swamp, low dune and waterhole. Coolibah along creek. 50% cover	
		
North-west branch of Cooper Creek	North-west branch of Cooper Creek	Cattle tracks in lignum wetland
Transect H	Habitat: Lignum flood plain. 75% cover	
Duma florulenta, Lignum with Coolibah.		

Census stop: CL10 Date: 01/08/2023 Start time: 09:30
Weather: Moderate wind, 0% cloud, 22C, Wind 10kph, SE
Number of observers: 9 (2 groups of 4 or 5)
Habitat: Dunes with ephemeral wetlands in the swales. Creek along western edge.

Transect A	Habitat: Sand plain leading to a dune. Many dead Coolibah. 30% cover	
Cattle tracks on sand plain.	Rabbit warren	Dingo tracks
		
Zygochloa paradoxa, Sandhill Cane-grass on dune crest.	*Triodia basedowii,* Hard Spinifex (front) and Sandhill Cane-grass on dune.	
Transect B	Habitat: Dune swale. Tussocks and dead saltbush. 40% cover.	
Sand plain between dunes. Many cattle scats.	Dead forbs. Cattle tracks.	Dune slope with heavy use by cattle.
Clay pan and lower dune. Heavy use by cattle.	*Acacia ligulata*, Dune Wattle	

Rabbit warren	*Zygochloa paradoxa*, Sandhill Cane-grass on dune crest	
Transect C	Habitat: Dune with scattered cane-grass and shrubs. 20% cover	
		
Lower dune and sand plain. Cattle tracks.	Dead saltbush on sand plain.	Saltbush on clay pan. Creekline in distance.
Transect D	Habitat: Salt pan with glasswort and saltbush. Most trees dead. 60% cover.	
Acacia sp.	Zebra Finch nest	Clay pan. Only salt-tolerant species surviving.
Sclerolaena bicornis, Goathead Burr	*Senecio magnificus*, Tall Yellowtop	Cattle track through lignum wetland
Isidorella newcombi	*Tecticornia tenuis*, Slender Samphire	*Lepidium sp.*

Transect E	Habitat: Low dune, lignum swamp with creek line. 60% cover	
Lignum swamp. Some cattle tracks.	Lower dune slope with saltbush.	
Transect F	Habitat: Creek bank with flood-out. Undulating sand plain. 50% cover	
Flood-out area. Acacia, Eremophila and Lignum. Grasses heavily browsed by cattle.	Dune slope. Coolibah along creek.	Dune slope leading to clay pan.
Inter-dune swale with clay pan and lignum wetland.		
Transect G	Habitat: Low dune, wetland with lignum and samphire. Coolibah at edge of dune. 30% cover	
Clay pan with *Tecticornia tenuis*, Slender Samphire, and dead lignum and samphire.	Clay pan with mainly dead vegetation.	

Transect H	Habitat: Lignum swamp. Dune with scattered Triodia. 40% cover	
Acacia ligulata, Dune Wattle		

APPENDIX V – CLIMATE

The area surveyed falls within the arid zone of north-east South Australia.

A. Rainfall

The closest weather station to the survey area is Bureau of Meteorology (BOM) station number 17028 at Innamincka Station. The rainfall record for this station goes back to 1883, but records are incomplete, with data for several months since 1993 missing so that a trendline would be inaccurate. Another nearby station with recent records is the Moomba Airport station, number 17123, about 66 km south-west of Innamincka, for which complete records are available from 1996. Fig. 6 shows a comparison of the annual rainfall data for these two stations since 1996. For both sites, the annual rainfall is seen to be extremely variable, although overall the trendline for Moomba shows a slight decrease. The BOM gives the mean annual rainfall for Innamincka as 178.6 mm and for Moomba as 178.5 mm.

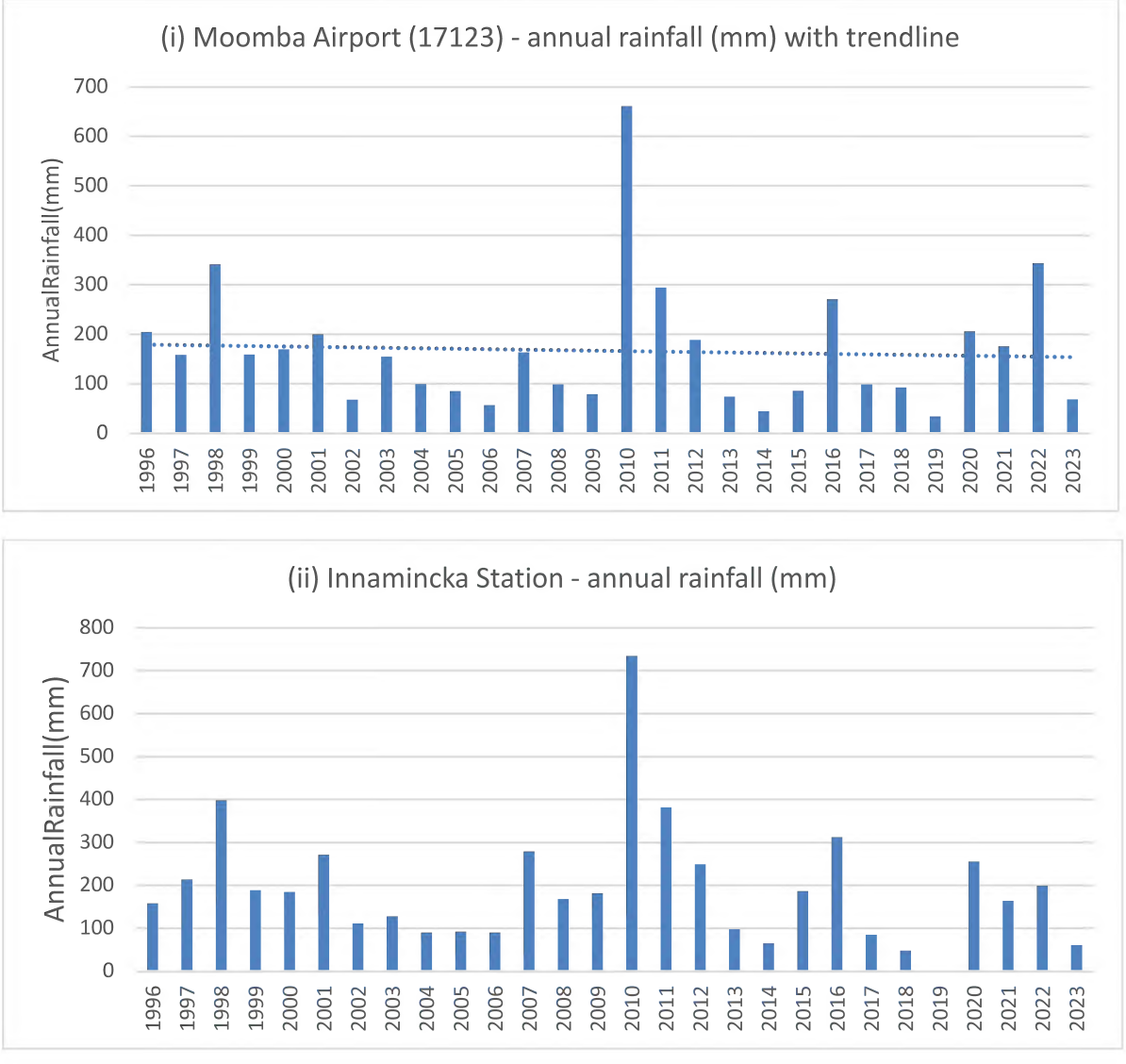


Fig. 6. Rainfall totals per year since 1996. Source: Bureau of Meteorology.

Records missing for Innamincka – 1 month for 6 of the years shown, 4 months for 2016, 11 months for 2019, 3 months for 2020 and 2 months for 2023; totals for available data shown but trendline unreliable.

Of particular relevance for this project are the rainfall records for the 12 months preceding the survey period. Fig. 7 shows that there were several small rainfall events recorded during these 12 months, with a drier period from January to May. Innamincka Station recorded a total of 21.1mm in June and 17.5mm in July (0.8mm on 2 July, 10.3mm on 4 July and 6.3mm on 29 July, i.e. during the survey period).

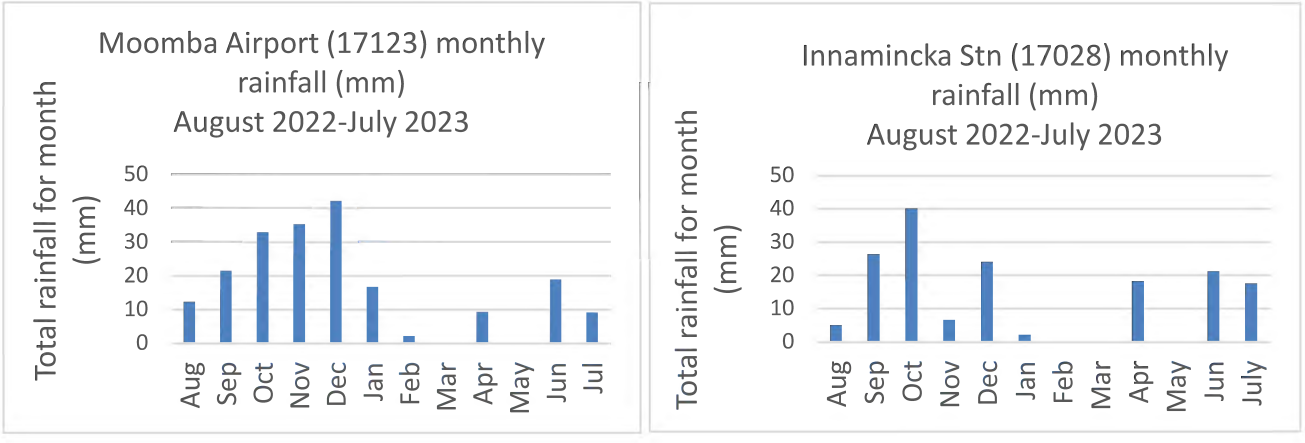


Fig. 7 Monthly rainfall for the 12 months preceding the 2023 survey (Aug 2022 - July 2023)
Source: Bureau of Meteorology.

Fig. 8 shows a comparison of the overall rainfall data for the region from the baseline survey year (2014) to the repeat survey year (2023), revealing an erratic weather pattern leading up to a wetter year in 2022 followed by a drier repeat survey year.

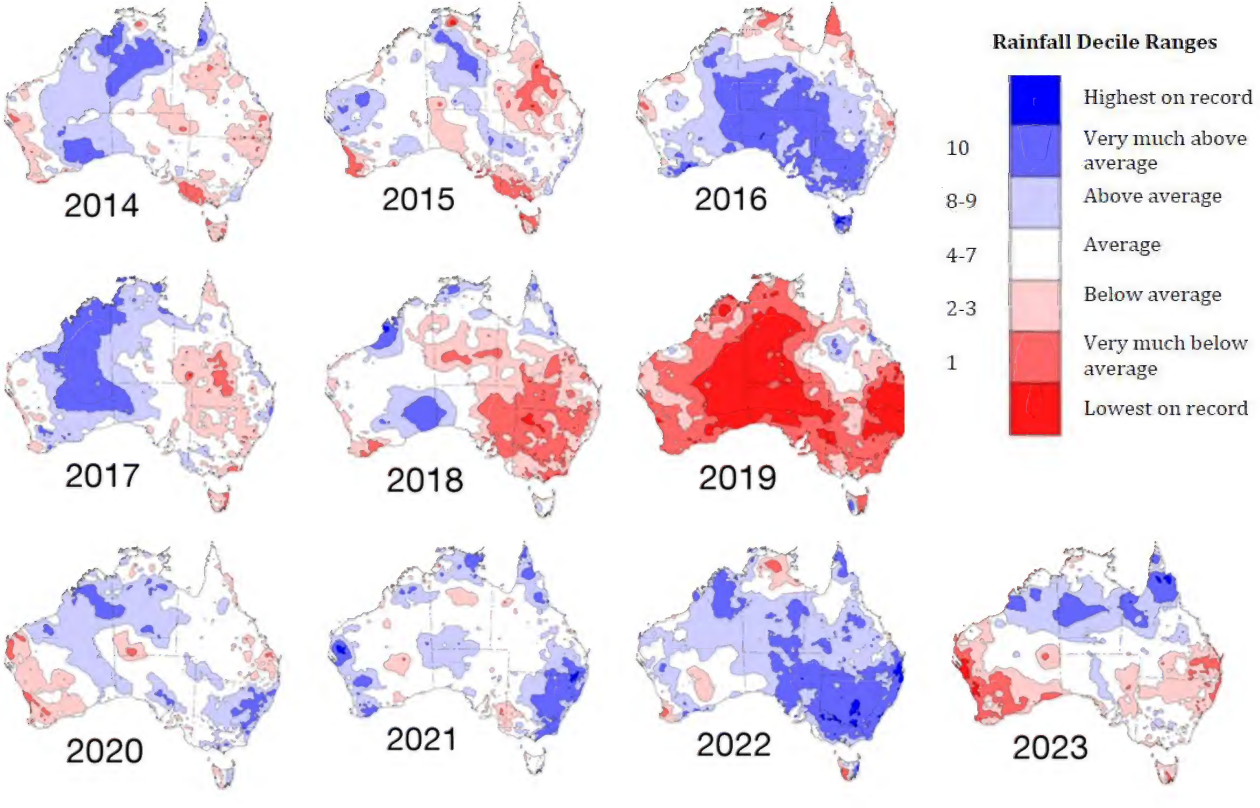


Fig. 8 Maps showing the decile rank of rainfall for each calendar year (2014-2023) based on 120 years of rainfall data[9].
Source: Bureau of Meteorology

[9] **Deciles** are used to give an element a ranking. If, for example, you had 40 years of annual rainfall records, you would first arrange the totals in ascending order (from lowest to highest). Next split them into 10 equal groups, so that in this example there would be 10 groups of four. The first group (four lowest annual rainfalls on record) would be in decile range one, the second group in decile range two, up to the four highest annual totals (highest 10 per cent) being in decile range 10.

B. Temperature

The closest weather station to the survey area that records temperature is Bureau of Meteorology station number 17123 at Moomba Airport. The temperature records go back to 1996. There has been an upward trend in mean daily maximum temperature per year over the period records have been collected. There were cooler temperatures in 2020-2022 when there was also relatively good rainfall but a marked increase again in 2023 (Fig. 9). These changes are paralleled in the 12-month mean temperature anomalies compared to a reference period (1961–1990) for the region over this period (Fig. 10).

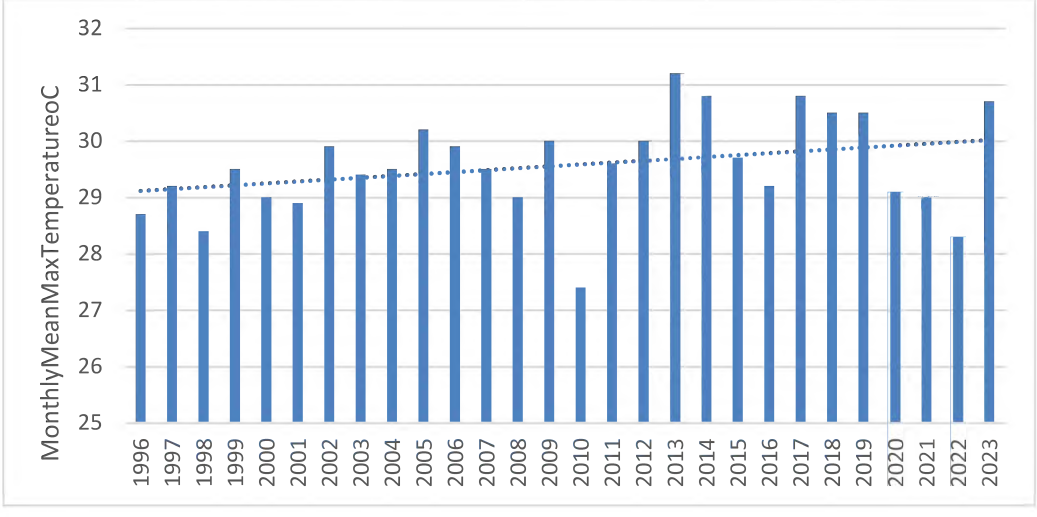


Fig. 9 Moomba Airport (17123) monthly mean maximum temperature with trendline (1996-2023). The monthly mean maximum temperature is the average of all available daily maxima for the month. The daily maximum air temperature is nominally recorded at 9 am local clock time. It is the highest temperature for the 24 hours leading up to the observation, and is recorded as the maximum temperature for the previous day. **Source**: Bureau of Meteorology

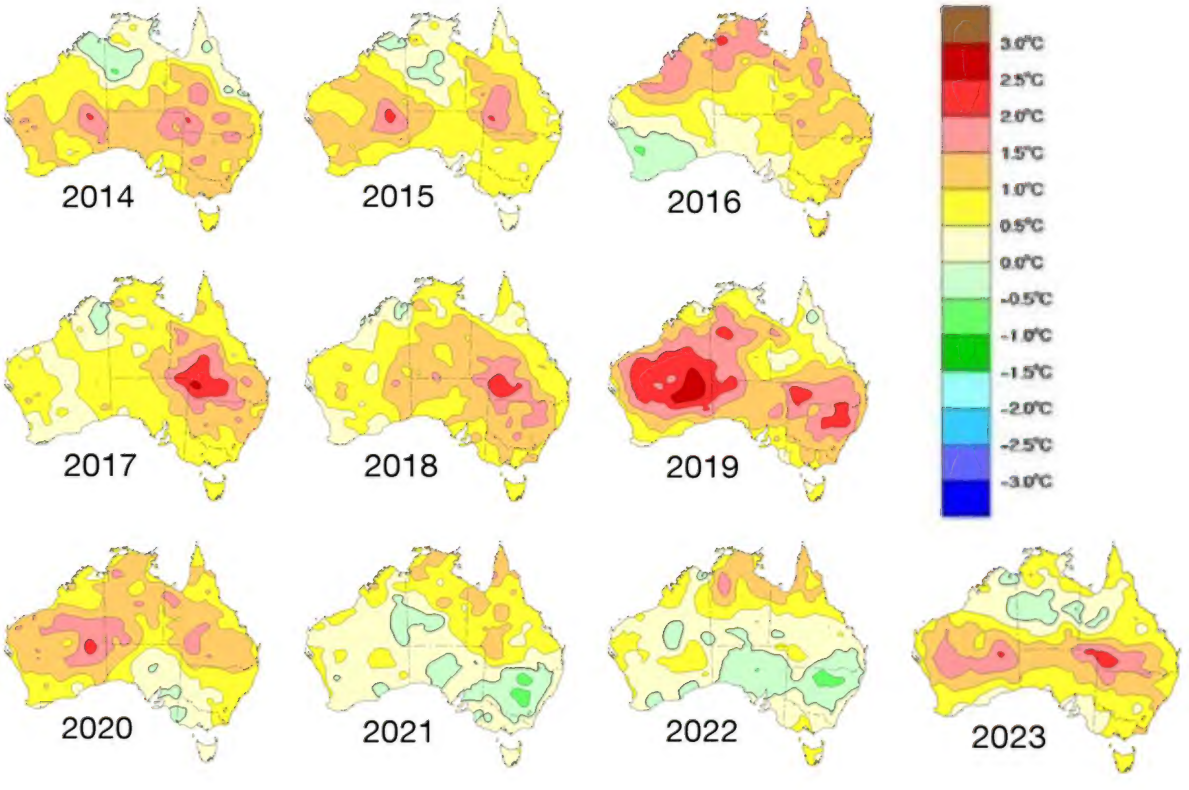


Fig. 10 12-monthly mean temperature anomaly
These maps show the anomaly of mean temperature (°C) for each calendar year, compared to the average over the standard reference period of 1961–1990.
Source: Bureau of Meteorology

APPENDIX VI – USING A GPS TO NAVIGATE TRANSECT SQUARES

Each survey team needs to have at least one member with a GPS unit and some basic skills in using it. Given that a variety of GPS units will be brought to the survey task by different volunteers, the following guidelines are generic in nature.

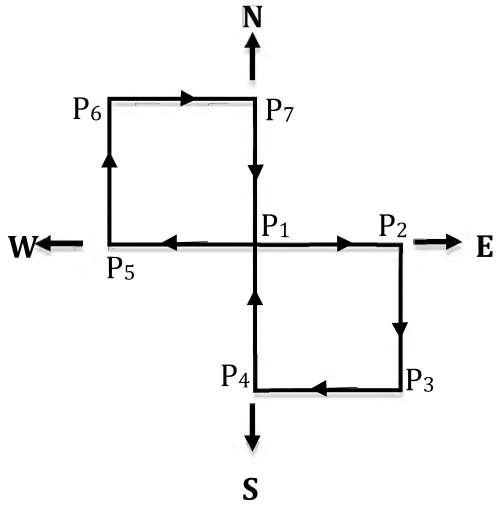
Two alternative methods are given below for navigating the two transect squares for each census stop.

Preliminary Skills

Users should come to the task knowing how to:

1. set up their GPS units to locate positions using
   (a) metric units
   (b) UTM position format
   [for the Innamincka area the UTM zone/band is 54 J and the position is given by a 6 or 7 digit **easting** (depending on whether or not the leading zero is shown) and and a 7 digit **northing**. E.g. 54 J 0467632 6929509. These numbers may appear on two lines, with the easting on the top line. The "54 J" may or may not be shown]
2. mark and find waypoints
3. show, not necessarily on the same page/screen
   (a) the easting and northing for the current position
   (b) the distance from a given waypoint

METHOD 1



Navigating Transect Squares

Starting at census stop 1 corner point 1 (P_1 in the diagram), the survey consists of two transect squares with the 500 m sides oriented along the principal compass directions as shown.

1. Mark P_1 as a waypoint on the GPS unit (e.g. call it waypoint 101). Record the easting and northing in a notebook (see Table below).
2. Select "Find" or "Go To" waypoint 101 – your unit should tell you that you are already there!
3. Walk in an easterly direction by keeping the northing constant (you may need to adjust it by veering southwards to reduce the northing to the desired value, or by veering northwards to increase the northing to the desired value). It is not necessary to be exactly due east of P_1 at all times so it is quite OK to make detours around obstacles such as thorn bushes!
4. While proceeding eastwards, check your distance from P_1 from time to time. When this distance approaches 500 m adjust your position so that your northing is exactly the same as at P_1 and your distance from P_1 is exactly 500 m. Mark this point as P_2 (e.g. waypoint 102) and record the easting and northing in your notebook.
5. Repeat the above process to locate P_3 , 500 m south of P_2 . This time you will need to keep the easting constant and the northing will decrease as you go.
6. Repeat the above process for each side of the two transect squares.

Notes

- Eastings get larger as you move eastwards and smaller as you move westwards. Northings get larger as you move northwards and smaller as you move southwards.
- A possible format for your record book is shown. Note that eastings and northings are alternatively equal as you move from one point to the next.

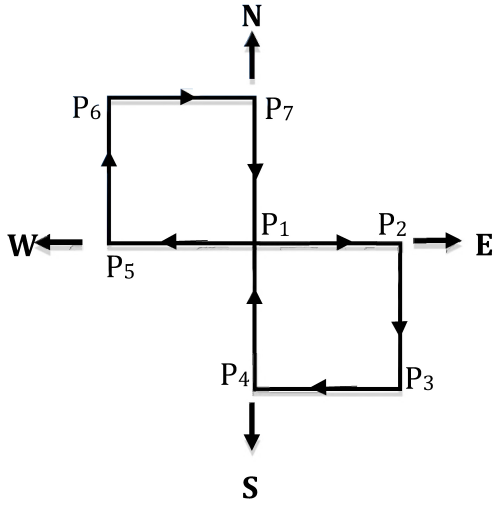
Census stop 1 Waypoints

Waypoint	Easting	Northing
101 (P_1)	a	b
102 (P_2)	c	b
103 (P_3)	c	d
104 (P_4)	a	d
101 (P_1)	a	b
105 (P_5)	e	b
106 (P_6)	e	f
107 (P_7)	a	f
101 (P_1)	a	b

METHOD 2

Navigating Transect Squares

Starting at census stop 1 corner point 1 (P_1 in the diagram), the survey consists of two transect squares with the 500 m sides oriented along the principal compass directions as shown.



1. Mark P_1 as a waypoint on the GPS unit (e.g. call it waypoint 101). In a notebook draw up a table as shown below and record the easting ('*e*') and northing ('*n*') of P_1.
2. Calculate the eastings and the northings for the other seven corner points of the survey squares by adding or subtracting 500 as shown by the formulas in the table. Enter all eastings and northings on your table.

Census Stop 1 Waypoints

Waypoint	Easting	Northing
101 (P_1)	*e*	*n*
102 (P_2)	*e*+500	*n*
103 (P_3)	*e*+500	*n*-500
104 (P_4)	*e*	*n*-500
101 (P_1)	*e*	*n*
105 (P_5)	*e*-500	*n*
106 (P_6)	*e*-500	*n*+500
107 (P_7)	*e*	*n*+500
101 (P_1)	*e*	*n*

3. Walk in an easterly direction by keeping the northing constant (you may need to adjust it by veering southwards to reduce the northing to the desired value, or by veering northwards to increase the

northing to the desired value). It is not necessary to be exactly due east of P_1 at all times so it is quite OK to make detours around obstacles such as thorn bushes!

4. While proceeding eastwards, monitor the easting of your current position. When this approaches the desired easting (*e*+500) adjust your position so that your northing is exactly the same as at P_1 (*n*) and your easting is exactly (*e*+500). You have now reached the point P_2 (waypoint 102).
5. Repeat the above process to locate P_3, 500 m south of P_2. This time you will need to keep the easting constant and the northing will decrease as you go.
6. Repeat the above process for each side of the two transect squares.

Note

- Eastings get larger as you move eastwards and smaller as you move westwards. Northings get larger as you move northwards and smaller as you move southwards.
- Example calculation:

Census Stop 1 Waypoints

Waypoint	Easting	Northing
101 (P_1)	*e* 0431028	*n* 6953816
102 (P_2)	*e*+500 0431528	*n* 6953816
103 (P_3)	*e*+500 0431528	*n*-500 6953316
104 (P_4)	*e* 0431028	*n*-500 6953316
101 (P_1)	*e* 0431028	*n* 6953816
105 (P_5)	*e*-500 0430528	*n* 6953816
106 (P_6)	*e*-500 0430528	*n*+500 6954316
107 (P_7)	*e* 0431028	*n*+500 6954316
101 (P_1)	*e* 0431028	*n* 6953816

While it would be possible to manually input these co-ordinates into the GPS unit and to then use the "Find" or "Go To" function, the process would be time-consuming and tedious, and the following of the direction arrow is not likely to give a more precise transect square than the method of maintaining eastings and northings detailed above.

APPENDIX VII - TRANSECT SHEET

This transect sheet was used for recording birds and other data during the survey. One transect sheet was used for each transect, a total of 8 sheets per census stop.

Transect Data 500m			
Survey:		**Date:**	
Census Stop No:		**Transect e.g. A, B, C:**	
Main habitat type:			
Weather:			
Start		**End**	
Corner point no.		**Corner point no.**	
Time:		**Time:**	
Latitude:		**Latitude:**	
Longitude:		**Longitude:**	
Species	**No.**	**S/H**	**Comments (eg breeding activity)**
Notes (including threats):			
Observers:			

APPENDIX VIII - EQUIPMENT LIST

- EPIRB (if you have one) or Satellite phone (if you have one)
- Hand-held UHF radio for staying in contact while surveying (*to be carried on your person at all times when out of the car, along with at least one set of spare batteries*)
- GPS for each group (*to be carried at all times when out of the car, along with at least one set of spare batteries*)
- Compass (*to be carried on your person at all times when out of the car*)
- Plenty of spare batteries
- Survey sheets and a clip board, notebook and pencils
- Watch for telling the time (or use GPS clock)
- Digital camera with large memory card. Set camera clock to local time to enable you to better relate photos to location.
- Small ruler or measuring card for photographing with tracks etc.
- Car chargers for the various pieces of electronic equipment / rechargeable batteries
- Star picket / dropper, plastic dropper cap, star dropper plunger
- Census stop marker plate stamped for census stop e.g. FOIR CS01, bolt, washer and nut, spanner
- Personal protective equipment (PPE)
- First Aid kit including snake bite kit